

## 2 Existing Conditions



## **2.1 PARK SUMMARY**

### **2.1.1 LAND USE**

Anza-Borrego Desert State Park® is classified in its entirety as a State Park, with approximately two-thirds of the land designated by the sub-unit classification of State Wilderness. Roughly 120,000 acres is designated as *State Park*: a land classification defined by California’s Public Resources Code, Section 5019.53 (see “Park-Wide Management Defined”). Roughly 400,000 acres is designated as *State Wilderness*: a sub-unit classification defined by California’s Public Resources Code, Section 5019.68 (see “Park-Wide Management Defined”).

Visitor-use facilities in ABDSP include campgrounds, picnic areas, a visitor center, trails, and roads. Although scattered throughout the Park, most of these facilities are concentrated in the Borrego Palm Canyon area adjacent to the community of Borrego Springs.

### **2.1.2 FACILITIES**

Current facilities within the Park include:

- £ · Visitor Center
- £ · Developed Campgrounds (Tamarisk Grove, Borrego Palm Canyon, Vern Whitaker Horse Camp)
- £ · Equestrian Campgrounds (Vern Whitaker Horse Camp)
- £ · Semi-Developed Campgrounds (Bow Willow)
- £ · Primitive Campgrounds (Culp Valley, Sheep Canyon, Arroyo Salado, Yaqui Pass, Yaqui Well, Fish Creek, Blair Valley, Mt. Palm Springs)
- £ · Maintenance and Administrative Facilities
- £ · Employee Housing
- £ · Roads, Trails, Kiosks, and Interpretive sites

(See Figure 7.1 “Facilities” for more detailed facility information, also see “Recreational Resources”.)

### **2.1.3 ADJACENT LAND USE**

With over 650 miles of border and roughly 50,000 acres of inholdings, ABDSP has an extensive assemblage of neighbors (see Figure 7.2 “Adjacent Land Ownership”, and Table 6.1 “Adjacent Land Use”).

#### **2.1.3.1 Native American Land**

Nearly 40 miles of border are shared between ABDSP and Native American land (overseen by the Bureau of Indian Affairs) including Los Coyotes Indian Reservation and the Santa Rosa Indian Reservation. The majority of this border is shared with Los Coyotes Indian Reservation in the San Ysidro Mountains. Other Native American lands border the Park in the Santa Rosa Mountains and numerous parcels are to the east, north of County Highway S22.

Potential future developments such as casino-resorts may increase regional development. A landfill was previously proposed for Los Coyotes Indian Reservation, an idea that may be revisited in the future. These land-use changes may result in habitat fragmentation, loss of biocorridors, and impacts to the natural viewshed, as well as possible effects on water quality and stormwater runoff.

The local Native Americans have extensive cultural ties to the region and can offer valuable insight for park staff and visitors.

#### **2.1.3.2 Federal Land**

##### **Bureau of Land Management (BLM)**

The majority of the ABDSP border south of Highway 78 is shared with the BLM. In total, nearly 240 miles of the Park’s border is adjacent to BLM holdings, with nearly half of those federal lands designated as BLM Wilderness. A significant portion of the BLM land within the Santa Rosa Mountains is designated The Santa Rosa and San Jacinto Mountains National Monument, a significant integration of State and Federal lands in a multi-agency effort to conserve biological and cultural landscapes, and open space.

The BLM works to protect resources and provide opportunities for recreation. Large areas of BLM Wilderness are contiguous with the Park and allow for some of the best natural and cultural landscape connectivity in California.

Although the BLM protects land for conservation and public use, this agency also allows for potentially impactful uses such as hunting, off-trail equestrian activity, collection of natural and cultural resources, and green-sticker vehicle use. The BLM also leases land to be used for agriculture, mining, and livestock grazing. The

majority of the shared border is not marked and therefore, these uses may cross into ABDSP and negatively affect the Park's resources. Lack of boundary marking also can lead to confusion among visitors.

### *U.S. Forest Service*

The Cleveland National Forest borders nearly ten miles of ABDSP. Adjoining U.S. Forest Service land is predominantly in the San Ysidro and Laguna Mountains. U.S. Forest Service Land provides publicly owned open space for positive recreation and conservation opportunities. U.S. Forest Service land significantly contributes to greater connectivity from the coastal mountains to the desert floor.

Hunting and off-highway vehicle use on U.S. Forest Service land may have negative effects that cross from U.S. Forest Service Land to ABDSP. Also, the fire management policies of this agency may conflict with those of California State Parks. Fees charged for day use (Adventure Pass) confuse visitors who may also be required to pay nearby state park "day-use" fees.

### *2.1.3.3 Other Parks*

#### *County*

Roughly ten miles of ABDSP borders City or County Parks including Agua Caliente, and Vallecito Stage Station County Parks.

Vallecito Stage Station County Park is located on 71 acres of San Diego County property adjacent to ABDSP. The park includes a restoration of the historic adobe stage stop, and a campground that includes 44 primitive sites and three group use areas. San Diego County Parks share many goals and objectives with ABDSP.



Agua Caliente County Park is operated by San Diego County Parks on 910 acres that is owned by California State Parks and is a part of ABDSP. The current operating agreement between the two agencies extends to 2008. Within Agua Caliente County Park are developed swimming and bathing facilities that open up natural hot springs to public use. The County also offers a 140-unit campground (many sites have full hook-ups), horseshoe pits, shuffleboard, and a children's play area.

#### *Cuyamaca Rancho State Park*

A little over five miles of the border of ABDSP adjoins Cuyamaca Rancho State Park. This connection was made in 2001 with the acquisition of the Lucky 5 Ranch. The importance of this connection cannot be overstated, as it secures a valuable

biocorridor, allowing for an unfragmented transition of State Park land, from coastal mountain range to desert floor. (See “Planning Influences, Landscape Linkages” for a further discussion on the nature and importance of biocorridors.)

#### *Ocotillo Wells State Vehicular Recreation Area (OWSVRA)*

Almost 35 miles of ABDSP, is adjacent to OWSVRA, south and east of the Borrego Badlands. Having this SVRA of over 42,000 acres so closely associated with the State Park allows redirection of off-highway vehicle use from ABDSP to the extensive off-highway vehicle recreation opportunities available “right-next-door”.

OWSVRA receives a high volume of off-highway vehicular recreation. ABDSP does not allow green-sticker vehicular use, nor are vehicles allowed to leave designated roads. The potential for off-highway recreationists from OWSVRA to unknowingly cross into ABDSP is high.

#### *2.1.3.4 Other State-Owned Land*

##### *California Department of Fish and Game (CDFG)*

Almost 15 miles of the Park’s border is shared with the CDFG. The most significant CDFG lands reside to the north in the Santa Rosa Mountains and to the west along the San Felipe Hills. CDFG strives to protect natural systems in California and provides avenues for people to enjoy nature.

The CDFG lands adjacent to the Park provide hunting opportunities that may have negative effects on some animal and plant populations of ABDSP. The borders are often not marked, allowing for potential poaching. CDFG also supports a game bird stocking program that may release exotic birds such as Chuckar, Pheasant, and Turkey, all of which compete with native species and may alter native ecological processes.

##### *State Lands Commission*

Just over 15 miles of ABDSP’s border is shared with the State Lands Commission with significant parcels to the east, north of County Highway S22, and to the south in the Table Mountain area.

#### *2.1.3.5 Private Operations*

The majority of ABDSP’s boundary is shared with private landowners, with roughly 230 miles around the Park’s exterior and roughly 65 miles of border contributed by inholdings. Major holdings of private land adjoin ABDSP in the western mountain ranges and contribute to the Park’s “checkerboard” ownership in the northwest. Border and trespass issues are prevalent throughout this region. The towns of Borrego Springs (nearly 48,000 acres) and Shelter Valley (nearly 2,000 acres) are completely surrounded by ABDSP. Agricultural and urban development on private

lands affects natural and cultural landscapes that cross ABDSP borders. Excessive agricultural use and development has overdrawn the Borrego Valley aquifer, which is a major issue for desert ecosystems.

The In-Ko-Pah Tower is a privately owned tourist attraction at the southernmost end of ABDSP, near the Mountain Springs area along Interstate 8. The four-story rock tower was built in the 1920s and serves as a museum and viewpoint.

### **Agriculture**



Roughly 25 miles of ABDSP's border is shared with agricultural operations. These activities may occur on private land or land leased from the BLM. In the Borrego Springs area, grapefruit is the major agricultural product, while vegetables and other crops are cultivated on the land east of the Park. Large-scale agricultural operations in the desert are a major concern for natural resources of ABDSP.

Over-consumption of water and depletion of the regional aquifers may eliminate much of the surface and subsurface water that supports the majority of the desert's biota. Nutrient-rich and pesticide-laden agricultural runoff may have irreversible effects on water quality.

### **Mining**

Nearly 21 miles of the Park's border is adjacent to mining activity. Mining operations may take place on private land or land leased from the BLM. The most significant operations include the U.S. Gypsum Mine, Wonderstone Mine, and Kennecott Gold Mine.

***U.S. Gypsum Mine:*** The U.S. Gypsum Mine adjoins approximately 4 miles of ABDSP boundary east of the mouth of Split Mountain Gorge and Fish Creek. This mine is a major source of dust and noise pollution. There is currently an effort to expand the U.S. Gypsum Mine activity along major portions of the border with the Carrizo Impact Area; this region is important for bighorn lambing and holds sensitive bat roosts.



***Wonderstone Mine:*** The Wonderstone mine lies east of the park, north of County Highway S22. This operation actively mines decorative rock.

***Kennecott Gold Mine:*** The Kennecott gold explorations border 2 miles of the north east corner of ABDSP in the Santa Rosa Mountains. If developed as an open pit with cyanide processing heaps, this mine has the potential to become a significant pollution source and visual intrusion on the desert scene.

Many small gold mining operations are still active southeast of Julian. Much of this mining activity is in the upper reaches of the watersheds that support riparian habitat and groundwater recharge. These activities may have a negative effect on the water quality, slope stability, and sensitive habitats of ABDSP.

#### ***2.1.3.6 International Land***

##### **Mexico**

Although ABDSP does not directly share boundaries with Mexico, the international border lies one mile from the southernmost border of the Park. Since ecosystems do not recognize borders, this proximity to Mexico allows the opportunity to collaborate internationally on research, education, and conservation.

ABDSP is a major route for illegal immigration. The constant activity of illegal immigrants and Border Patrol vehicles is having a major negative effect on the natural resources of the Park, especially in the south part of the Park.

#### ***2.1.3.7 Transportation Corridors***

##### **Auto**

County Highway S2 runs north-south through the lower half of the park from Ocotillo, traversing near Bow Willow, Canebrake, and Mountain Palm Springs, and through Shelter Valley to Scissors Crossing. Interstate 8 crosses the southern tip of ABDSP. Highway 78 travels east-west between Julian and Ocotillo Wells State Vehicular Recreation Area. County Highway S22 travels east-west through Montezuma grade, Borrego Springs, and Truckhaven Rocks. County Highway S3 goes through the Park from Borrego Springs, to Tamarisk Grove.

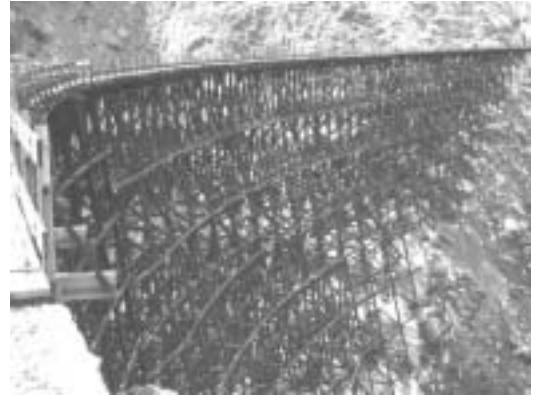
While the existing road system is critically important in providing vehicular access throughout the park, there can be negative effects to the park itself. Bighorn Sheep get run-over by vehicle traffic and the roads inhibit the sheeps' migration. People throw trash, littering the landscape. Traffic volume affects desert solitude, and roadways slice across the natural scene with an artificial intrusion. Many people who travel through the Park have no interest in and perhaps minimal awareness of being in a state park.



### **Rail**

Nearly 2,500 acres of land is held by the Metropolitan Transit Development Board; purchased from the San Diego and Arizona Eastern Railroad. The railway occupies a swath of land that snakes up Carrizo Gorge as an inholding within the park. The railroad represents a rich part of the desert story and is an attractive educational opportunity.

The railroad includes tunnels and bridges that have fallen into disrepair and, therefore, could be a safety hazard. Since it is currently non-active, the railroad corridor has an uncertain impact to the Park; however, if put into use, it may have significant impacts to the Park's resources.



#### **2.1.4 LAND ACQUISITION**

The majority of land is acquired through the cooperative efforts of the Anza-Borrego Foundation. Acquisitions are only pursued with those willing to sell or donate land. Some characteristics that have made a parcel of land desirable for acquisition include:

- £ · Completion of biocorridors and additional habitat connectivity (especially connectivity between coastal mountains and desert floor), as well as completion and protection of watersheds and natural processes
- £ · Significant natural resources (i.e. wetland and riparian habitats, paleontological resources, designated Critical Habitats, significant wildlife populations, ecological systems, and biological landscapes)
- £ · Cultural sites and landscapes
- £ · Expanded opportunities for staff and visitor-use facilities and visitor-use areas (e.g., existing facilities, previously disturbed sites, locations allowing for improved staff and visitor access)
- £ · Opportunities to minimize negative adjacent land use effects (e.g., light pollution, noise, viewsheds and sense of solitude disruption, regional aquifer depletion and contamination, poaching and trespassing, and inholdings that complicate holistic land management)

## **2.1.5 PARK SUPPORT—ORGANIZATIONS AND VOLUNTEERS**

### **2.1.5.1 Park Support Organizations**

**Anza-Borrego Foundation:** To help protect the spectacular wilderness of ABDSP, the California Parks and Recreation Commission in 1967 asked a group of concerned citizens to help the State acquire inholdings (private parcels of land surrounded by public land). As the Anza-Borrego Committee of the Desert Protective Council, this group began the work of identifying and purchasing critical properties for the Park. In 1989, the Anza-Borrego Foundation, a charitable trust under the Desert Protective Council, reorganized as an independent charitable 501(c) 3 nonprofit corporation, to carry on the work of the Anza-Borrego Committee.

The mission of the Anza-Borrego Foundation is to support and acquire land for ABDSP through donation or purchase from willing sellers. Acquisition priorities are determined with assistance from park staff and incorporated into an acquisition plan by the Foundation. The Foundation, governed by a 15-member volunteer board, acts as a land trust that then transfers the acquired property to the Park for preservation and management. The Foundation seeks donations of land wherever possible but also buys from willing sellers.

There is no other organization that works to acquire property for ABDSP. The foundation provides an efficient mechanism by which funds are raised, acquisitions made, and property transferred to the Park. The Foundation can act quickly on sensitive purchases that would otherwise be lost due to the state's inability to respond promptly.

**The Anza-Borrego Institute™:** The Anza-Borrego Institute™ is a partnership between California State Parks, the Anza-Borrego Foundation, and the UC Davis Wildlife Health Center. The goal of The Anza-Borrego Institute™ is to create a world-class facility and center for research, education and interpretation of the Anza-Borrego region. To combine existing components, including the Stout Research Center, Colorado Desert Archaeology Society, Anza-Borrego Desert State Park Paleontology Society, Backcountry Seminars, interagency studies, and outdoor education, under one management umbrella. The mission of The Anza-Borrego Institute™ aims to provide unequalled opportunities for research, education, and interpretation of the natural and cultural resources of the Anza-Borrego region to young people, the scientific community, and the general public, in order to enhance knowledge and inspire responsible environmental ethic.

#### 2.1.5.2 *Park Support Volunteers*

ABDSP Volunteers assist Park staff in a multitude of ways, including but not limited to the following:

- £ · Visitor Center – Volunteers provide information to the public, plan and present interpretive programs, help maintain structures and grounds, and assist with school groups and special programs. Visitor Center Volunteers and Volunteer Naturalists are required to complete an initial training program as well as yearly refresher training.
- £ · Paleontology – The Anza-Borrego Desert Paleontology Society was formed in 1993 as a State Park Volunteer group to assist staff in the management and care of paleontological resources. Society members are Certified Paleontology Volunteers, required to complete an in-class training program as well as hands-on work in the field, laboratory, and curation.
- £ · Archaeology – The Colorado Desert Archaeology Society was formed in 1995 as a State Park Volunteer group to assist staff in the conservation and management of the archaeological resources of ABDSP and other units in the Colorado Desert District. Society members are required to complete certification training covering the goals and ethics of professional archaeology, and methods of archaeological field survey, site recordation and collections curation.
- £ · Campgrounds/Trails – Volunteers, including Camp Hosts, provide information and assistance to hikers, campers, and other park visitors.
- £ · Natural Resources – Volunteers assist with a variety of natural resource projects, including the radio-telemetry tracking of mountain lions and bighorn sheep and the annual three-day bighorn sheep count.
- £ · Other Clubs and Organizations (e.g., Equestrian groups, Youth organizations, Four-Wheel Drive Clubs, etc.). The organizations help clean up and maintain various areas of the Park (e.g., Horse Camp clean up, road and trail maintenance, etc.), and also work on specific, smaller projects of educational interest (e.g., working with paleontological or archaeological staff for a day).

## **2.2 SIGNIFICANT RESOURCES**

### ***2.2.1 PHYSICAL RESOURCES***

#### ***2.2.1.1 Topography***

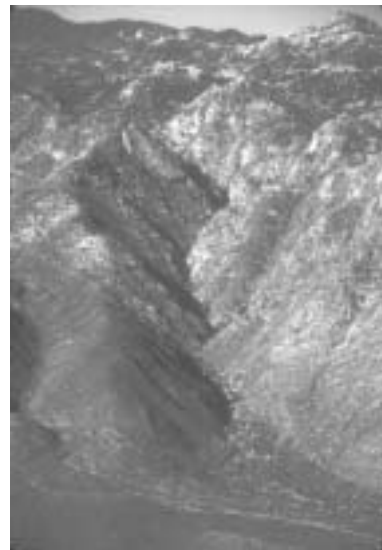
The topography of ABDSP provides a unique character to the Park and has a major effect on meteorology, hydrology, soils, vegetative communities, wildlife habitat use, and human use patterns of the past and present (see Figure 7.3 “Topography”).

ABDSP contains over 600,000 acres in San Diego, Imperial, and Riverside counties. The Park requires thirty-four 7.5-minute United States Geological Services (USGS) topographical maps to cover its 70-mile (113 km) length and 30-mile (48 km) width. Elevations range from 16 feet (4.8 m) above sea level on the tufa-covered ancient shorelines of Lake Cahuilla to 6,193 feet (1,888 m) on the pine-clad slopes of Combs Peak. Topographic relief is diverse and in some cases extreme. On the western face of the Santa Rosa Mountains, slope has been calculated at 2,400 feet per mile (45.5%).

The granitic Peninsular Ranges forms the Park’s western boundary. Coulter Pines, Interior Live Oaks, and Pinyon Pines shroud the ridges of ABDSP’s high country. Deep canyons with perennial water support native California fan palms. The canyon mouths often give way to spectacular alluvial fans such as those found at Clark Dry Lake, Borrego Palm Canyon, and the Hellhole alluvial fan – site of the Park’s Visitor Center.

ABDSP is earthquake country. The landscape shows many elongated ridges and valleys which trend northwest-southeast along the scores of active faults, in the zone where the North American Plate clashes with the Pacific Plate. Topographically enclosed drainage basins contain interior valleys with no outlets. Known as dry lakes or playas, they can be found in Blair Valley, Little Blair Valley, and Clark Dry Lake.

Standing on the Peninsular Ranges looking out over the ridges and valleys of the Colorado Desert, views far in the distance reveal a wrinkled and twisted landscape known as the badlands. About one-third of the Park is made up of ancient sea bottom, shoreline, marsh, and inland lake deposits. As one looks out across this tortured landscape, one scans over the perfect definition of topography.



Mountain masses are scattered throughout ABDSP like so many islands in a sea of desert. Though related to the backbone of the Peninsular Ranges and made of the same parent rock, the Park's many interior ranges represent "islands" of isolated habitat, torn from the parent range by slow creep along deep faults, cataclysmic landslides, or slumping. These "islands" of mountain masses carry names such as Coyote, Tierra Blanca, the Sawtooth, In-Ko-Pah, Jacumba, Vallecito, Santa Rosa, and Fish Creek. This fragmentation of mountain masses is reflected today in the fragmentation of plant and wildlife species. Indeed, Elephant Trees, Bighorn Sheep, the Pinyon Pine, and Cottontop Cactus are all inextricably linked to their "islands" of desert mountain ranges.

Every range in the Park holds traces of fault-scarps, slumps, shear zones, offsets, and terraces. These linear features are evidence that the landscape is alive, dynamic, and ever changing.

#### 2.2.1.2 *Geology*

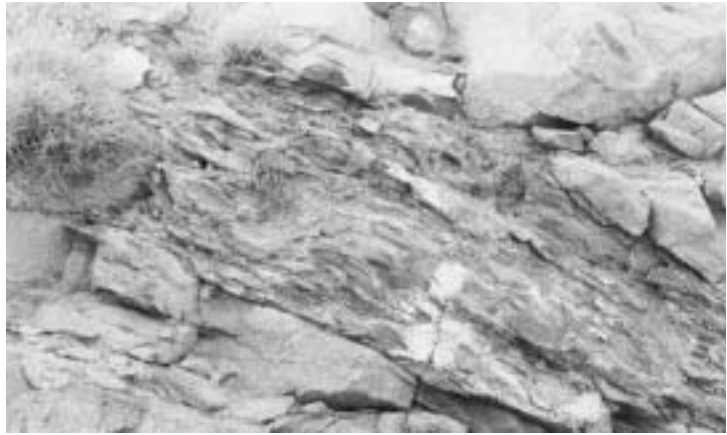
The spectacular desert vistas and colorful badlands terrain typical of ABDSP are largely a result of the Park's geological formations, geological history, and tectonism. ABDSP lies in a unique geological setting along the western margin of the Salton Trough. This major topographic depression forms the northernmost end of an active rift valley and continental plate boundary. The Trough extends north from the Sea of Cortez to San Geronio Pass, and from the eastern rim of the Peninsular Ranges east to the San Andreas Fault Zone. Over the past 7 million years (MY), a relatively complete geological record of over 20,000 feet (6.1 km) of fossiliferous marine and terrestrial sediment has been deposited within ABDSP, along this rift valley's western margin.

The geological features of the region were first described by Blake in 1853 (Conrad 1855). Blake served as geologist and mineralogist for the U.S. Pacific Railroad Exploration commissioned by Congress and President Pierce to find a railway route to the Pacific. It was Blake who named southeastern California the "Colorado Desert." However, it was not until the late 19th and early 20th century, prompted by the search for minerals and petroleum (Bowers 1901), that geological studies again focused on the ABDSP region. They have continued since.

Much of the following summary was extracted from Belluomini and Van Gilder (2000), *Anza-Borrego Desert State Park Geology*, an inventory of the geology and geological features of ABDSP compiled by the Department of Water Resources. The report contains a selected set of seismicity and geological hazard maps not included herein.

### *Regional Geomorphology*

Two geomorphic provinces dominate the regional geological setting of ABDSP: the Peninsular Ranges and the Colorado Desert. The Peninsular Ranges geomorphic province consists of a vast complex of batholithic rocks that extends from Baja California northward to the Transverse Ranges. At the northern end, the San Andreas Fault truncates the Peninsular Ranges and the Transverse Ranges. The eastern escarpment of the Peninsular Ranges reveals a series of well-exposed fault blocks. These detached blocks, created from the opening of the Salton Trough, provide the Park with striking relief features of metamorphic and igneous basement rock and both marine and colorful terrestrial sedimentary rock.



The Colorado Desert is a region bounded on the east by the Colorado River, on the west by the Peninsular Ranges, on the south by the Sea of Cortez, and on the north by the Transverse Ranges. The province has northwesterly geological structural trends exhibited by faults, mountain ranges, and the Salton Trough. The Salton Trough is a complex pull-apart structure resulting from the northwesterly separation of the Pacific Plate, including the Peninsular Ranges, from the North American continental tectonic plate. This is the direct result of crustal spreading beneath the Trough that began about five MY ago (Norris and Webb 1990).

### *Structural Geology*

Exposures of much of the basement rock encountered in the Park are the result of westward and northward thrusting and folding that occurred in southern California in the late Cretaceous Period, 97 to 66 MY ago. This period of deformation is well recorded in the Santa Rosa and San Ysidro Mountains. The folding and thrusting of marine shelf sediments over and along the rising Peninsular Ranges batholith formed a series of imbricate stacks of metasediments. These metasediments structurally overlie the plutonic terrane of the Peninsular Ranges batholith.

A second period of deformation occurred in the mid-Tertiary. During this episode, east-west extension and north-south compression folded much of the basement complex (Engel and Shultejahn 1984). This is evident in the fold axis and lineations of the basement rock. In ABDSP these rock types can be found on the eastern side of the San Ysidro Mountains from Yaqui Ridge to Coyote Canyon. They are also

located on Coyote Mountain and the Santa Rosa Mountains (Sharp 1979; Simpson 1984).

Great Basin regional extension occurred between 22 and 14 MY and is marked locally by the Alverson Andesite or Jacumba Volcanics (Kerr and Kidwell 1991). Down-dropped margins created during the extension became the site of alluvial and fanglomerate deposition. The sediments found in the down-dropped margins include crystalline and metamorphic basement rock, and lower to mid-Miocene (22 to 14 MY) volcanic rocks.

During this period, detachment faults developed along the flanks of the San Ysidro Mountains west of Borrego Springs. These detachment faults are undulating, terraced surfaces, which steepen abruptly along the plutonic front of the Peninsular Ranges batholith. These features are also the most westerly indication of the extensional tectonics of the Salton Trough.

Another episode of north-south folding is evident in the late Cenozoic deposits, from the Santa Rosa Mountains southeastward through the Superstition Hills and Superstition Mountain. According to Dibblee (1984), "These folds are most numerous and tightly compressed adjacent to the major faults of the San Jacinto fault zone west of the Salton Trough." This is an indication that they formed by lateral drag and/or transpression from right-slip motion on faults in the underlying basement.

### *Geological Formations and Stratigraphy*

**Basement Rock:** Basement rock exposures consist primarily of metamorphosed sedimentary rocks of Paleozoic age (540 to 245 MY) and plutonic rocks of the late Mesozoic age (165 to 65 MY). They are distributed throughout the Park along the uplifted margins of the Elsinore and San Jacinto fault zones. Extensive exposures of basement rock occur in the Santa Rosa, San Ysidro, Vallecito, Laguna, Jacumba, and Coyote Mountains.





***Coachella Group:*** The Coachella group (Remeika 1995) consists of a series of non-marine sandstones, conglomerates, fanglomerates, catastrophic landslide deposits, and rift-related andesitic volcanic deposits of early to late Miocene age (c. 25 to 6 MY). The units in the Coachella group are the Anza Formation, the Alverson Andesite (Jacumba volcanics), Split Mountain Formation, and the Fish Creek Gypsum. Sedimentary units of the Coachella group nonconformably overlie basement rock throughout ABDSP, and the Anza Formation represents the first sedimentary deposit containing locally derived clasts of basement rock. The Coachella group crops out primarily as scattered erosional remnants in the Fish Creek and Coyote Mountains. Other exposures include the southern tip of the Santa Rosa Mountains, Borrego Buttes, and within Split Mountain Gorge.

The late Miocene (c. 6 to 5 MY) Fish Creek Gypsum (Dean 1988) consists of nearly pure massive beds of gypsum (>95% calcium sulfate,  $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ ). The deposit averages 100–200 feet (30–61 m) thick and is exposed continuously for about 2.5 miles (4.0 km). The Fish Creek Gypsum is found primarily along the northwest flank of the Fish Creek Mountains, with minor occurrences in the Coyote Mountains to the southwest. It is a unique geological formation of either evaporitic or hydrothermal origin (Jefferson and Peterson 1998). The main body of this deposit is located outside of ABDSP and is currently being mined by U.S. Gypsum Company.



***Imperial Group:*** The late Miocene to earliest Pliocene (c. 10 to 5 MY) Imperial group (Remeika 1998) consists of the Latrania formation, the Coyote Mountain Clays, and the Yuha formation. The Latrania formation is a transgressive sequence of sandstones representing the first incursion of marine waters into the Salton Trough. It is very fossiliferous, dominated by a distinct subtidal to intertidal molluscan fauna. It is exposed in the Coyote Mountains, Fish Creek Mountains, and in the Vallecito Mountains.

The early Pliocene (c. 5 MY) Coyote Mountain Clays are exposed in the Fish Creek Mountains, the Coyote Mountains, the Carrizo Badlands, and along Fish Creek



Wash in the southern portion of the Park. The clays were deposited in an offshore shelf environment over a wide expanse.

The early to late Pliocene Yuha formation (4.3 to 3.2 MY) is a fossiliferous rhythmic series of fluvial and deltaic silt and mud. The formation consists of oyster coquina beds (the Elephant Knees) interbedded with fluvial sands of the ancestral Colorado River. Sediments of the Yuha Formation are exposed in the southern Borrego Badlands, in the southwestern portion of the San Felipe Hills, in the Fish Creek Badlands, in the western Carrizo Badlands, and in the Coyote Mountains.

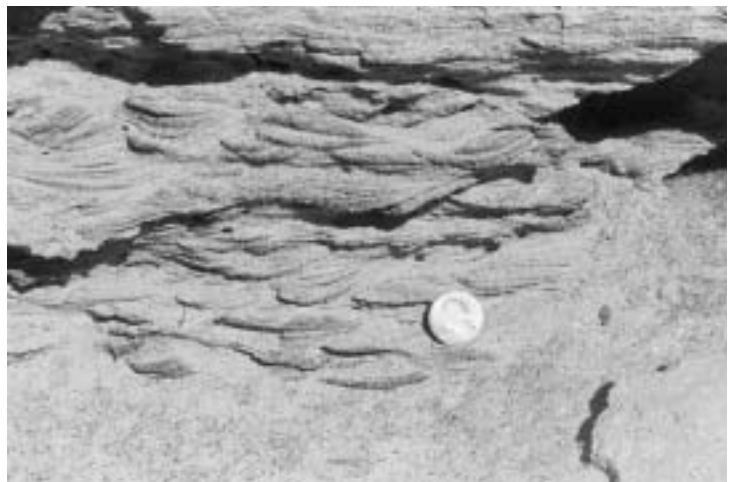
**Colorado River Group:** The Colorado River Group consists of Pliocene–Pleistocene (c. 5.3 to 1.0 MY) deposits laid down by the ancestral Colorado River. The Colorado River group conformably overlies the units of the Coachella group. The units included are the Palm Spring Formation, the Borrego Formation, and the Brawley Formation.

The Plio-Pleistocene (5.3 to 1.0 MY) Palm Spring Formation is a high-energy, nonmarine delta-plain deposit of the ancestral Colorado River. The beds are massive containing abundant concretions with subordinate, ripple-laminated, overbank claystones and siltstones. Total thickness of the unit exceeds 8,200 feet (2,500 m). Exposures occur in the southern Borrego Badlands, San Felipe Hills, Carrizo Badlands, eastern half of the Vallecito Badlands, and the Fish Creek Badlands.

The late Pliocene and Pleistocene (c. 3.4 to 1.6 MY) Borrego Formation is exposed in the Borrego Badlands, Ocotillo Badlands, Santa Rosa Badlands, and San Felipe Hills. It does not occur in the Vallecito–Fish Creek Basin. The Borrego Formation is a low-energy, lacustrine/estuarine deposit. Sediments include dark red-brown to light-gray claystones with subordinate siltstone and sandstone; lacustrine deposits of the Brawley Formation overlie it.

**Anza-Borrego Group:** The Anza-Borrego group consists of locally-derived sediments. These range from lacustrine silts and clays to boulder sized fanglomerate deposits. It includes the Canebrake Conglomerate, the Ocotillo Conglomerate, and the Bautista beds.

The late Pliocene to middle Pleistocene (c. 3.4 to 0.7 MY)



Canebrake Conglomerate is a sequence of coarse-grained alluvial and conglomerate deposits. The unit is approximately 7,000 feet (2,133 m) in thickness at the basin margins. It is widely distributed along the eastern margin of the Tierra Blanca Mountains in upper Fish Creek Wash, Sweeney Pass, the Santa Rosa Mountains, the Coyote Mountains, and Harper Canyon.

The Pleistocene age (1.25 to 0.37 MY) Ocotillo Conglomerate is an alluvial and fluvial deposit of medium to coarse-grained sands and overbank silts (Remeika and Jefferson 1995). The unit thickens to the southwest to a maximum of approximately 800 feet (244 m) (Dibblee 1954).

The mid to late Pleistocene age (0.8 to 0.5 MY) Bautista beds are locally derived alluvial and fluvial basin deposits exposed in the Coyote Badlands and Clark Lake along traces of the San Jacinto fault zone.

### **Significant Geological Features**

**Alluvial Fans:** Alluvial fans are striking geological features found within and around the Park. Deposited by fluvial activity at the mouth of narrow mountain valleys, these broad gently sloping accumulations of loose rock material often mark the boundary between the faulted blocks and the broad valleys found in the Park. The alluvial fans have developed as a depositional feature along with continued uplift of the mountain fronts.

They can be found along the narrow canyon openings of the Santa Rosa, San Ysidro, Vallecito, Tierra Blanca, and Coyote Mountains. Along most mountain fronts, the fans often combine, creating what is termed a bajada as seen along the base of the Santa Rosa Mountains in Clark Valley.



**Badlands:** Badland topography is marked by extremely rough, high, narrow, and steeply cut ridges, gorges, and canyons. Badlands occur in poorly consolidated, erodible sedimentary rocks, where high-intensity storms cause rapid erosion on a nearly vegetation-free landscape. The dissected badlands unveil the Park's geological history with well-exposed strata and provide a window into paleontological resources. The badlands are spectacular features of the Park. They are fragile and subject to rapid changes from both natural causes and anthropogenic interference.

The Vallecito Creek Badlands, Carrizo Badlands, and Fish Creek Badlands are located in the Vallecito Creek/Fish Creek Basin in the south-central portion of the Park. These eroded features occur primarily in the Palm Spring Formation and the Canebrake Conglomerate. Vertical relief in many of the channels exceeds 500 feet (152 m).

The Borrego Badlands are located east of Borrego Springs in the Font's Point and Borrego Mountain quadrangles. A breathtaking view of the Borrego Badlands can be easily gained from Font's Point. The Borrego Badlands occur primarily in the Ocotillo Conglomerate, Borrego, and Palm Spring Formations.



The Santa Rosa Badlands are located on the southern flank of the Santa Rosa Mountains, and are well developed in the Truckhaven Rocks area. They occur primarily in the Borrego and Palm Spring Formations.

**Faults:** In the Salton Trough, the most dominant structural features are faults. These trend northwest–southeast, and include the San Andreas, San Jacinto, and Elsinore fault zones. Along with regional extension, they account for the current geological structure of the region. The primary displacement along the fault zones is right-lateral; however, vertical displacement has also occurred as suggested by the moderate to high relief features found in the Park and the local mountain fronts (Engel and Schultejan 1984).

The San Andreas Fault enters the Salton Trough at the northwest end of the Coachella Valley. This fault system constitutes the main structural boundary between the Pacific and North American tectonic plates. Regionally, the fault is traceable from the town of Niland east of the Salton Sea northward through San Geronimo pass. The fault zone continues southward into Mexico as the Sand Hills and Algodones Fault. The plate boundary southward is marked by a series of “en echelon” spreading centers in the Gulf of California (Crowell 1981). The San Andreas Fault exhibits right-lateral motion with an approximate offset of 200 miles (322 km). The offset in southern California is estimated to have begun in the late Miocene and early Pliocene (10 to 5 MY) (Kerr and Kidwell 1991).

The San Jacinto fault zone is a major strand of the San Andreas Fault system. It extends southeastward from Cajon Pass as a series of splays into the Salton Trough. In ABDSP, the San Jacinto fault zone branches into the Clark Valley fault, the Coyote Creek fault, and the Superstition Hills and Superstition Mountain faults. The San Jacinto fault is an extremely active system. The Coyote Creek fault is the longest fault in the area.

Right lateral displacement on the San Jacinto fault zone is approximately 19 miles (31 km). Vertical separations along the zone exceed 8,000 feet (2,438 m) in the Santa Rosa Mountains. Where the fault zone enters ABDSP, high-standing mountain blocks are flanked by alluvium-filled depressions. An example is Coyote Mountain and the flanking Borrego and Clark Valleys. The Clark branch of the San Jacinto fault zone is Plio-Pleistocene in age (c. 2 MY to present). The Coyote Canyon branch is younger than 1.0 MY as indicated by lateral offset of the late Pleistocene Bautista beds in Coyote Canyon (R. Dorsey, personal communication 2001).

The Elsinore fault zone extends from the northern Peninsular Ranges southward to the Gulf of California. The fault is parallel and west of the San Jacinto fault zone. In ABDSP, the Elsinore fault separates the San Ysidro, Vallecito, and Fish Creek Mountains from the Laguna and In-Ko-Pah Mountains on the west. Right lateral displacement along the main fault trace is approximately 30 miles (48 km). Vertical displacement and relief features along this fault reach as much as 9,000 feet (2,743 m). The Elsinore fault zone is considered to be older than the San Jacinto fault, between 1.8 and 2.7 MY (Magistrale and Rockwell 1996).



Agua Caliente Springs is located on the western edge of the Park along the Elsinore fault and north of the Tierra Blanca Mountains. This geothermal source is used for recreational purposes and is leased to San Diego County Parks.

**Mud Caves:** The Vallecito Creek Badlands is geologically unique with regard to the size and variety of mud caves. Sometimes referred to as pseudokarst terrain, the caves form in clay-rich sediments and mimic the morphology and hydrology of limestone dissolution. Along Arroyo Tapiado Canyon, numerous blind valleys, sinkholes, pits, and caves can be found. The largest, Carey's Big Cave, is over 1300

feet (396 m) long. Chasm Cave has over 1010 feet (308 m) of passage with few skylights. Other notable caves include Hidden Cave, Little Mud Cave, “E-Ticket” Cave, and Plunge Pool Cave. All these caves are found in Arroyo Tapiado Wash, approximately 2 miles (3.2 km) from its confluence with Vallecito Creek.

Cave formation occurs during infrequent periods of heavy rain when flash floods carve narrow and twisting canyons through the soft mudstone. Continued cutting by meandering flows develops long sinuous caverns. Eventually, the cavern ceiling thins to the point of collapse. The collapsed features can be seen as remnant arches. Many caves have developed internal arches, subterranean dry waterfalls, and secondary passages, which create an unrivaled inner beauty.

***Lake Cahuilla Shoreline:*** Ancestral Lake Cahuilla once occupied a majority of the Salton trough. Outlines of the ancient shoreline stand out dramatically along the eastern flank of the Santa Rosa Mountains at an elevation of about 40 feet (12 m). Calcium carbonate algal tufa deposits (oncoids) are sporadically found along the margins of the ancestral lake and in the stratified sediments in the Borrego Badlands as old as 0.1 MY (D. Ryter, personal communication 2001).

#### **Mines and Minerals**

The mineral resources of the ABDSP region are significant (California Division of Mines and Geology 1963, 1977). Minerals of interest include several precious metals and gem quality non-metals. The Public Resources Code prohibits commercial exploitation of mineral resources in units of the State Park System.

Early mining in the region began in the 1870s after placer gold was discovered near Julian. Julian is a small community that once fostered a population of 40,000 during the mining boom. The Julian Gold District lies approximately 15 miles (24 km) west of ABDSP and attracted many prospectors to hunt for gold and other precious minerals in the area.

Other commodities sought after included gem quality tourmaline and associated pegmatite minerals, manganese, strontium, tin, tungsten, limestone, sand, and volcanic ash. Many of these original prospects are now within ABDSP.

***Polaroid Calcite Mine:*** Located in the northeastern portion of the Park is an abandoned calcite mine that received considerable attention during WW II (Orrell 1993). Discovered in 1939 by prospector John Hilton, hydrothermally deposited calcite was mined for its optical use by Polaroid Corporation. Quality Optical calcite was used for gun sights for the U.S. Navy. Active operation of this mine ceased in late 1944 or early 1945.

***U.S. Gypsum Company Mine:*** Adjacent to the park, this large and active mine is located along the north end of the Fish Creek Mountains about 8.5 miles (13.6 km) south-southeast of Ocotillo Wells. The deposit contains nearly pure massive beds of gypsum (Fish Creek Gypsum). The plant capacity has been estimated to be about 2,268–2,721 million tons (2,500–3,000 tons) per day.

It is developed as an open pit mine. The ore is used as a casting base, soil conditioner, cement retarder, hardwall plaster, and dry wall.



### **Geological Hazards**

***Rock Falls and Landslides:*** Many canyon walls within badlands areas of ABDSP are subject to landslides or primary rock falls (see Belluomini and Van Gilder 2000). High, near-vertical faces developed by erosion of soft sedimentary formations characterize these areas. Under such conditions, slope failure is common and may be triggered by seismic activity.

***Subsidence and Collapse:*** Subsidence caused by ground water overdraft for agricultural and recreational use may be a problem along the borders of the Park and for the town of Borrego Springs.

### **Earthquakes and Seismicity**

ABDSP lies in a region of very high seismicity (see Belluomini and Van Gilder 2000). In the event of an earthquake, a reconnaissance-level survey of the Park for rock falls, landslides, ruptures, and liquefaction should be conducted. Few recorded sources document the direct effects of earthquake activity within the park. Significant earthquakes may occur on the following faults (described above): the San Andreas fault zone, potential local magnitude 7.0; the San Jacinto fault zone, potential local magnitude 6.5; and Elsinore fault zone, potential local magnitude 6.0 (Working Group on California Earthquake Probabilities 1988, 1995).

### 2.2.1.3 Soils

The soils of ABDSP have not been mapped, however, in the early 1970s the United States Department of Agriculture (USDA) conducted a soil survey in San Diego County that inventoried the soils of Borrego Springs, Shelter Valley, the majority of the Park's western border, and portions of the Park's eastern border. This soil-mapping project encompassed a broad "transect" through the region and likely documents the majority of soils found in ABDSP. The soil series documented in this survey for these regions are reported in Table 6.2: "Potential Soil Series". Detailed information on these soil series is contained in the national Soil Survey Geographic (SSURGO) Database, available on the internet from the USDA-Natural Resources Conservation Service (NRCS) Soil Survey Division.

The majority of the soils throughout ABDSP consist of various grain size sand and sandy loam. These soils are highly erosive, especially when located within a major watercourse or subject to flash flooding.

Soil is a key component of terrestrial ecosystems and provides a base for many of the processes that support life. Incorporating soil dynamics into management decisions is perhaps most important in the desert environment, where the extremes of climate have placed pressures on life, unparalleled in many other terrestrial environments. Desert soils possess a complex community of living organisms that facilitate the establishment and existence of the majority of the desert's biodiversity (Bainbridge and Virginia 1995). These soils, rich in life, are easily disturbed by human activity and are extremely slow to recover (Webb 1983; Prose and Wilshire 2000).

One important component of desert soils is the surface, or cryptogamic crust. Undisturbed cryptogamic crusts may contain types of algae, fungi, lichen and nitrogen-fixing bacteria which act to reduce erosion, increase infiltration, soil fertility and soil moisture, and create a favorable environment for the establishment of seeds (Bainbridge and Virginia 1995).

Below the surface crust, other important components of desert soils include root-associated mycorrhizae and rhizobia, which are beneficial in increasing nutrient and water acquisition and important for fixing nitrogen into desert soils. Ants, termites, nematodes, soil mites, protozoa, and small mammals also contribute important elements in soil structure, moisture, and the availability and cycling of nutrients and minerals (Bainbridge and Virginia 1995; Zac and Freckman 1991). Open camping and off-trail hiking are popular activities that may have subtle yet significant negative effects on the desert ecosystem.



#### 2.2.1.4 *Meteorology*

##### *Global and Regional Patterns*

The climate of ABDSP and the surrounding region is shaped both by global weather patterns and regional topography. Located at approximately 33 degrees north latitude, the Park is well within the influence of the “horse latitudes” where high atmospheric pressure and warm, dry air are almost daily conditions. California receives most of its winter rain from storms originating in the North Pacific Ocean. The rainfall from these storms is heaviest in the north and diminishes to the south; therefore, San Diego, Riverside, and Imperial counties receive only a small part of this precipitation. In summer, a high-pressure system routinely moves into position off the central California coast and deflects Pacific storms away from southern California.

The Peninsular Ranges heavily influences ABDSP’s climate. In winter, southeastward-trending Pacific storms bring rain to coastal areas of southern California. As these storms move inland, they encounter a series of mountains that impede their eastward movement. Rainfall can be quite heavy in the mountains, but by the time these storms reach the desert, they are nearly dry. This process, whereby the mountains block Pacific storms from reaching the deserts, is known as the “rain-shadow effect.”





### Severe Storms

Several times each century large tropical storms originating in Pacific waters off southern Mexico wander off their normal path and travel north as far as southern California and Arizona. These powerful weather systems, often called “hundred-year storms”, can deliver enough precipitation in a single 24 hour period to more than double the desert’s average annual rainfall. Typically, rainfall of such storms varies greatly from one location to another within the Park and the resultant floods can endanger lives and cause extensive damage.

### Precipitation

Rainfall in the Park varies with elevation and proximity to the mountains. A considerable portion of the Park is located in elevated mountainous terrain, where the precipitation is often much heavier than it is on the desert floor. Rainfall measured at the *Borrego Desert Park Station* (Park Headquarters) is widely quoted as the official precipitation for the Park and the community of Borrego Springs. In reality, the rainfall measured at that station (6.2 inches mean annual) is not truly representative of rainfall across the desert floor portion of the Park. Every weather station in the Park which is east of, or lower than Park headquarters records a lesser amount of rain, ranging from 2.3 inches less at the *Borrego County Road Station* (Rango Way) to 3.6 inches less at the *Ocotillo Wells Station* (State Highway 78 at OWSVRA).

Most of the rain that falls in San Diego County, whether it’s on the coast, in the mountains, or in the desert, comes during the cool months of November through March. A second rainy season occurs between July 1 and September 30, but the west to east pattern is largely reversed.

During summer storms, unpredictability is the key word to describe rainfall patterns. One of the most extreme examples occurred on September 23, 1976, when a localized thunderstorm opened up over Borrego Valley. Four inches of rain were recorded at the *Borrego County Road Station*, while four miles away, only 1.35 inches was collected at *Borrego Desert Park Station*. It is common to see a summer cloudburst over a single canyon, while every other nearby canyon remains completely dry.

### Temperature

ABDSP experiences mild temperatures in the winter months, and hot temperatures in the summer. Extreme high and low temperatures in the Park vary tremendously from winter to summer, within a month, and even within a single day. The coldest day ever recorded at the *Borrego Desert Park Station* was in January of 1971 when the extreme low was 20°F (-7°C). The highest reading was 121°F (49°C) in July of 1995.

In a typical year in ABDSP, monthly extreme high temperatures go over 85°F (29°C) as early as March, and are routinely over 100°F (38°C) by May. From June through September, the monthly extreme high temperatures will routinely exceed 110°F (43°C). Not until November will monthly maximum temperatures stay consistently below 100°F (38°C). While extreme low temperatures do occasionally dip into the 20s°F (-7°C), those temperatures are uncommon.

### *Humidity*

Relative humidity is correlated closely to storm activity, and since ABDSP does not experience large numbers of rainstorms, average humidity tends to stay at moderate to low levels. Mean monthly relative humidity figures are highest from December through March. In April and May, the humidity drops slightly, and typically reaches its lowest values in June.

### *Wind*

Winter storm front winds, Santa Ana winds, and down canyon winds are among the major wind types occurring in ABDSP. These winds typically affect the entire Park during their periods of activity and are associated with, and highly influenced by the steep mountain scarp on the Park's western border. Wind is a major mechanism for sand transport throughout the Park and it is important for natural processes such as the formation and movement of sand dune systems.

The most severe and persistent winds are associated with winter storm fronts. As these storms crest the mountains and descend to the desert floor, their associated winds can accelerate to speeds exceeding 40 miles (64 km) per hour. The Pacific storm season begins as early as November, and can persist well into May. Although there is constant, Park-wide frontal wind during a winter storm, Coyote Canyon, Montezuma Valley-Tubb Canyon, San Felipe Creek, and Mason Valley are among the main wind funnels known to consistently exhibit above-average and sometimes dangerous wind velocities.

Santa Ana winds are observed in fall and early winter. Spawned by high-pressure systems in the interior western states, warm, dry air is pushed westward, losing moisture and gaining heat as it moves. In most of ABDSP, the result is light winds, usually not exceeding 15 miles (24 km) per hour, extremely low humidity, and high visibility. For the most part, these winds bring very pleasant conditions to the desert floor.



However, as these dry continental winds climb over the mountains, wind velocities can increase dramatically, especially below certain canyons on the western slopes. In December of 1996, winds reached a velocity of 85 to 90 miles (137 to 145 km) per hour in the vicinity of Santa Ysabel, just a few miles west of Julian, and the Park's western boundary.

In late spring, the strong frontal winds, which spill off the western mountains, are replaced by milder down-canyon winds. These winds are similar to the frontal winds, but their pattern is more predictable, and their velocity is usually lower. They are typically described by afternoon down-canyon breeze or wind, usually ending by midnight.

### *Air Quality and Pollutants*

Because of its protected location and distance from major urban pollution sources, ABDSP has good air quality. However, air pollution in the form of smog, chemical fumes, smoke, and particulate matter is evident on occasion. Many of these pollutants are carried into the Park from outside sources, but some are produced within it. Currently, no agency actively monitors the air quality within ABDSP.

A major portion of the air pollution affecting ABDSP is wind-transported and likely arises from urban sources such as San Diego, Riverside, and the greater Los Angeles area. Tropical storm fronts occasionally enter the Park from the east, carrying quantities of fine dust and silt. This load of particulate matter completely engulfs the land as it travels, obscuring the sky with a thick yellow-brown layer.

Ocotillo Wells State Vehicular Recreation Area, located between State Highway 78 and County Highway S22, hosts a large number of off-highway vehicles during the visitor season. Consisting largely of motorcycles, quads, and dune buggies with minimal exhaust equipment, these vehicles produce a substantial volume of exhaust emissions and dust. Just south of State Highway 78, also against the Park's eastern boundary, is the large, open pit mine operated by U.S. Gypsum. A substantial volume of dust (composed primarily of calcium sulfate) is generated by the removal and transport of this material.

There is also air pollution generated inside the boundaries of the Park. Highway-legal vehicles operating on the 500 plus miles of highways and primitive roads in the Park produce exhaust emissions and contribute to the air-borne particulate matter (dust and sand). Campers and picnickers produce



small quantities of smoke with their cooking fires and outdoor barbecues. ABDSP itself maintains three gasoline-fueling stations, a dozen propane storage tanks, and has a large fleet of gas-burning vehicles. Several Park buildings contain fireplaces, wood-burning stoves, or gas furnaces.

Two small communities, Borrego Springs and Shelter Valley, are located within the boundaries of the Park, and each produces its share of residential air pollution, such as smoke and gas fumes. In addition, Borrego Springs has a small number of light commercial and industrial pollution sources including gasoline filling stations, pest control services, golf courses, a concrete batch plant, as well as many acres of citrus, date and palm farms. The tree farms and orchards within the community of Borrego Springs produce several forms of pollution, with aerial spraying of pesticides and smoke from the burning of tree cuttings among the most prominent.

#### *2.2.1.5 Hydrology*

California is divided into nine regions administered by the California Regional Water Quality Control Board (CRWQCB 1994). ABDSP lies within two of these regions: Region 9–Colorado River Basin and Region 7–San Diego Basin. Approximately 99% of the Park lies within Region 9, which includes all lands with waters tributary to the Salton Trough.



Parklands that occur on the western slope of the Peninsular Ranges are within Region 7. California Department of Water Resources (CDWR) divides California into ten Hydrological Regions along similar, but not identical lines as CRWQCB. ABDSP lies within the Colorado River and South Coast Regions of this partitioning.

#### *Watersheds*

Watershed drainages emanating from the Peninsular Ranges make their way east along expansive arroyos to the Salton Sea, 235 feet (72 m) below sea level. Major drainages of the Park are Rockhouse Canyon, Coyote Creek, Borrego Palm Canyon, Tubb Canyon, Grapevine Canyon, San Felipe Creek, Fish Creek, Rodriguez and Oriflamme Canyons, Vallecito Creek, Canebrake and Bow Willow Canyons, and Carrizo Creek. These watersheds gather tremendous loads of rainwater, rock, and sediments, gouging deep arroyos in some places, while creating huge alluvial fans in others. These flows result in persistent issues with the integrity of the Park's primitive road system as well as Park signage and visitor safety.

### Surface Waters

Over two hundred water sources have been documented and plotted on ABDSP's geographical information system (GIS) hydrology layer. Water sources range from perennial streams and year-round springs along fault lines; seasonal seeps which flow only in high rainfall years; to deep rocky basins known as *tenajas*, which may hold water for a few weeks.

Surface water is scarce in the Colorado Desert, and when rain falls, it is unable to soak into the dry earth. Runoff is typically high and the unprotected soil erodes easily during violent storms. Mountains are etched with V-shaped canyons cut to bedrock by the erosional processes of runoff. When streams leave the mountainous areas their gradients decrease and deposition increases. From this point on, the stream channels are renamed washes and typically only possess surface flows during periods of intense rainfall. When streams and washes reach the alluvium-filled valleys their flows infiltrate the sediments and become the main source of ground water for the valley aquifers.

**Streams:** Approximately 2,000 miles (3,219 km) of perennial and intermittent streams have been mapped within the Park and are delineated on USGS topographic quadrangle sheets. Of these, Park staff has documented 36 miles (58 km) of perennial streams.

Thirteen major points of perennial upwelling have been mapped and these permanent upwellings generally occur where subsurface flows are forced to the surface for a short distance before once again sinking below the stream channel alluvium. These upwellings are typically caused by hydrological controls of bedrock located near the surface of the alluvium-filled stream channels.

For the most part, desert streams remain dry during most of the year. Sections of streams including Coyote Creek, Nance Canyon, Parks Canyon, North and South Forks of Alder Canyon, Sheep Canyon, Cougar Canyon, Borrego Palm Canyon, North, Middle and South Forks of Borrego Palm Canyon, South Fork of Hellhole Canyon, Tubb Canyon, San Felipe Creek, Grapevine Canyon, and Carrizo and Vallecito Creeks sustain year-round flow.



San Felipe Creek spans over 50 miles (80 km) and is fed by at least 35 side-canyons on its route from Teofulio Summit to the shores of the Salton Sea. Carrizo Creek has its meager beginnings on the Mexican border at Jacumba and drops through Carrizo Gorge, into Carrizo Wash, Carrizo Marsh, and on to the Salton Sea. The waters of Coyote Creek start in the high reaches of the Santa Rosa Mountains near Toro Peak, and descend almost 9,000 feet (2,743 m) to the depths of the Salton Trough.

Another source of permanent water generally associated with stream channels is *tenajas*. These large, bedrock tubs or tanks are generally of sufficient capacity to sustain stored water between flow events. They are typically deep with a small surface area and are generally located in protected situations. These factors reduce evaporation, leading to their sustainability. *Tenajas* can also be supplied from subsurface flow and seeps.

The most dramatic surface water events in desert areas are flash floods. Flash floods are defined as the sudden torrent of a great volume of water over a short duration, overflowing stream channels and filling narrow canyons. They usually occur in regions with semi-arid climates and carry an immense load of mud and rock fragments. Flash floods in ABDSP result from rare and brief heavy rains that fall over relatively small surface areas with steep slopes. The most recent devastating regional floods were the result of tropical storms Kathleen in September 1976, and Doreen in August 1977. These floods resulted in deposition of substantial amounts of sediment in Carrizo Marsh. In the case of Tropical Storm Doreen, homes in the De Anza Desert Country Club and nearby areas suffered 1.5 million dollars in damages.

Flash floods can be particularly dangerous in the Park due to its vast size and the confined and incised nature of the canyons and washes. They are dangerous to park visitors and have the potential to destroy dwellings, structures, vehicles, and other features.

***Springs and Seeps:*** A spring is a concentrated discharge of groundwater, appearing at the ground surface with a current of flowing water. To be distinguished from springs are seepage areas, which indicate a slow movement of groundwater to the surface (Todd 1980). Springs and seeps are found throughout the park and are often associated with geological



formations such as faults. There are nearly 100 springs and seeps in the Park, with the majority of these surface water expressions located along the western region of the Park (see “Sensitive Habitats, Small Springs and Seeps”).

***Other Surface Water:*** Surface bodies of water other than springs and stream channels are scarce within the Park. They can be divided into five types: dry lakebeds that occasionally fill for short periods after major storm events (Clark, Blair Valley, and Little Blair Valley Dry Lakes); marshes/ciénagas (Sentenac Ciénaga, and Carrizo Marsh); artificial ponds (Borrego Springs Campground and Visitor Center); reservoirs (CDF stock pond near the Sunrise Highway); and guzzlers. Guzzlers are man-made structures that collect rainfall through sheet flow by means of a funneling apron. Collected water is stored in a protected reservoir for wildlife usage. Ten of these structures have been constructed and are maintained within the Park.

### **Ground Water**

Ground water originates mainly from precipitation and subsequent infiltration through soils and surface rocks into saturated subterranean water-bearing bodies termed aquifers.

In California and particularly within the Colorado Desert Region, ground water basins are in relatively arid valleys where most of the precipitation occurs at the higher elevations in the mountains. Natural recharge of the aquifers occurs mainly by percolation from the mountain streams as they enter and flow across the valleys.

CDWR’s Colorado River Region covers approximately 13 million acres (52,609 km<sup>2</sup>) of which approximately 8 million of these acres (32,374 km<sup>2</sup>) cover 61 ground water basins and areas of potential ground water storage (CDWR, 1975). Approximately 192,000 acres (777 km<sup>2</sup>) of these ground water basins occur within the Park.

A Park-specific ground water basin map was produced and includes 22 ground water basins recognized by CDWR’s Bulletin 118 and CRWQCB-CRB’s (1994) Regional Water Quality Control Plan. Two of these basins, Davies Valley and McCain Valley, are located outside the boundaries of ABDSP. Of the remaining 20 basins, only the Collins Valley, Pinion Area, Whale Peak, and Horse Canyon aquifers are located entirely within Park boundaries.

***Water Wells:*** Water wells are vertical or horizontal holes developed in order to obtain ground water, subsurface stream flow, or spring and seep. Vertical wells generally tap groundwater. Horizontal wells are generally used in aquifer and subsurface stream flow extraction when adverse circumstances preclude installing vertical wells. Park wells that exemplify these methods include: vertical extraction of ground water (Horse Camp and Borrego Palm Canyon); vertical extraction of



stream underflow (Tamarisk Grove); and horizontal development of springs (Bow Willow Campground).

### *Water Rights*

Areas to the north, west, and south of the Park could contain diversions that impact surface and subsurface flow within ABDSP. As of 1998, there were 13 applications for the appropriation of unappropriated water and 26 statements of diversion and use, which were located and identified as being within watersheds tributary to Parklands. Total recorded diversions upstream from the Park in acre-feet per annum (AFA) were 317 in San Felipe Creek, 1,718 in Vallecito Creek, and 644 Carrizo Creek. There are also permits for the diversion of 4,423 AFA, diverted just south of the Ocotillo Flat area on Coyote Creek, a diversion point within the Park. In total, two applications and four statements have points of diversion within ABDSP. These points are generally located in lower Coyote Canyon, Hellhole Canyon, and Tubb Canyon.

Further review of the watersheds lying west and south of the Park's boundary revealed that seven reservoirs are within the Tule Creek and upper Carrizo watersheds, and a pond-like structure exists in the Cuyamaca Quadrangle. The morphology of the majority of these reservoirs indicates that they are on-stream reservoirs formed by the creation of a dam. The Division of Water Right files do not indicate diversion rights to these reservoirs, and therefore, no diversion data has been located.

Upper Tule Creek drains the McCain Valley area, and upper Carrizo Creek drains the Jacumba Valley area. Both of these areas contain private land holdings where farming and ranching operations exist. There could be many unreported direct diversions in these areas which can only be substantiated by directly observing the diversion facilities, contacting land owners, or in the case of the reservoirs, requesting that the Division of Water Rights investigate the apparent diversions.



## 2.2.2 BIOTIC RESOURCES

### 2.2.2.1 Paleontology

The fossil remains from ABDSP represent a variety of changing environments and habitats. Over 550 types of fossil plants and animals have been reported, ranging from preserved microscopic plant pollen and algal spores to baleen whale bones and mammoth elephantid skeletons. The most significant and abundant of these are the remains of late Miocene–Pliocene terrestrial vertebrates and marine organisms that range in age from about 9 to 4 million years (MY) old, and Pliocene–Pleistocene terrestrial vertebrates that date from 4 to about 0.4 MY ago. Combined with a long and complete regional geological sequence in ABDSP, these ecologically diverse fossil assemblages are an unparalleled and highly significant paleontological resource of international importance. Both the Plio–Pleistocene Epoch boundary and the Blancan–Irvingtonian North American Land Mammal Age (NALMA) boundary fall within the terrestrial section. These strata also record marine and terrestrial faunal interchanges on a continental scale, and provide a key to understanding of the origin of southwestern deserts.

ABDSP lies in a unique geological setting along the western margin of the Salton Trough. This major topographic depression forms the northernmost end of an active rift valley and geological continental plate boundary. The Salton Trough extends north from the Sea of Cortez (Gulf of California) to San Geronio Pass, and from



the eastern rim of the Peninsular Ranges east to the San Andreas Fault Zone. Over the past 10–9 MY, a relatively complete geological record of over 20,000 feet (6 km) of fossiliferous sediment has been deposited within ABDSP along the western margin of this rift valley.

The principal fossil-producing geological units (see Figure 7.4 “Paleontological Sensitivity”) include the Imperial and Palm Spring Formations in the Vallecito/Fish Creek Basin and Coyote Mountains region, the Imperial Formation, Palm Spring

Formation, and Ocotillo Conglomerate in the Borrego Badlands and Borrego San Felipe Basin and Truckhaven Rocks region, and the Bautista Formation in Coyote Canyon (see Winker and Kidwell 1996, Remeika 1998). Eroded badlands exposures of these sediments cover over 160 square miles (102,000 acres) of ABDSP. Along the west side of the Salton Trough, some of the stratigraphic units extend east and southeast from ABDSP, across Ocotillo Wells State Vehicular Recreation Area, and the Superstition Hills on Bureau of Land Management (BLM) property, reaching the Salton Sea. They also occur to the south in the Coyote Mountains and Yuha Desert on BLM lands, and extend into Baja California del Norte, Mexico.

Blake first reported invertebrate fossils from the Colorado Desert region in 1853 (Conrad 1855). Vertebrate fossils were first found in what is today ABDSP by C. Alverson and reported by Bowers (1901) 31 years before the Park was established. ABDSP fossil collections housed at the Colorado Desert District (CDD) Stout Research Center (DSRC) are largely comprised of materials recovered by the Imperial Valley College Museum (IVCM) and the Natural History Museum of Los Angeles County (LACM). Scientific paleontological investigation of these significant resources has continued since the last part of the 19<sup>th</sup> century.

General mandates related to paleontological resources are found in the Public Resources Code (PRC) Division 1, Chapter 1, Article 1; Division 5, Chapter 1, Article 1, Section 5019.53; and Division 5, Chapter 1.7, Section 5097.5. Specific directions concerning identification and protection of paleontological resources are also found in the California State Parks Operations Manual (Section 1831[4]: 40–41). California State Parks adheres to the basic content of the American Association of Museums *Code of Ethics* for museum curators. The *Paleontologic Resources and Collections Management Policy, Colorado Desert District* (Jefferson 1996) specifically follows the Society of Vertebrate Paleontology *Bylaw Article 9: Statement of Ethics*. For an in-depth review of the paleontological resources of ABDSP see Jefferson (1999b). A discussion of ABDSP's paleontological collection is found in Section 2.2.6: Collections .

### *Paleontological Resources*

The oldest reported fossils from ABDSP area are conodonts (tooth-like structures from agnathan vertebrates) of early Ordovician age, *ca.* 450 MY (Dockum and Miller 1982; Miller and Dockum 1983). These occur in the marine metasediments east of Carrizo Mountain that also are correlated with the Santa Rosa Formation along the crest of the Santa Rosa Mountains, north and northeast of Clark Dry Lake.

Cretaceous plant pollen, spores, and dinoflagellates (Fleming 1993a, 1993b, 1994; Fleming and Remeika 1994; Remeika and Fleming 1994, 1995) are known from Pliocene formations in the Vallecito Creek/Fish Creek Basin. These microfossils were eroded from Mesozoic aged strata on the Colorado Plateau and were

transported by the ancestral Colorado River into the Salton Trough. Reworked Cretaceous foraminifera have been identified from the same geological units (Merriam and Bandy 1965). Reworked Eocene plant microfossils also have been described from the Vallecito Creek/Fish Creek Basin (Fleming 1993a, 1993b, 1994; Fleming and Remeika 1994; Remeika and Fleming 1994, 1995).

A broad diversity of invertebrate remains has been recovered from the Imperial Formation in the Vallecito Creek/Fish Creek Basin and Coyote Mountains (see CSP 2000, Paleontology Resource Inventory). These organisms include calcareous nanoplankton and dinoflagellates, plant pollen and spores, foraminifera, sponges, corals, polychaeta, bivalves, gastropods, echinoderms, and crustaceans. Many of these forms are related to Caribbean species, and represent a time several MY prior to the emergence of the Isthmus of Panama.

In many areas, marine invertebrate fossil remains are well preserved and abundant. Carbonate platform, outer and inner shelf, near-shore and estuarine/brackish depositional marine environments are represented (CSP 2000). Thick channel deposits of predominately oyster and pecten shell coquina typify the latter.



The Imperial Formation also yields fossil marine vertebrates (Mitchell 1961; Deméré 1993; Thomas and Barnes 1993). The taxa represented include shark and ray, bony fish, baleen whale, walrus, and dugong.

The Pliocene aged Carrizo Local Flora (Remeika et al. 1986; Remeika and Fleming 1995) includes a palm, a cupressid, and deciduous hardwoods from the Palm Spring Formation in the Vallecito Creek/Fish Creek Basin and Borrego San Felipe Basin. Mid to late Pleistocene fossil woods have been recovered from the Ocotillo Conglomerate in the Borrego Badlands (Remeika, personal communication 1996).

Lacustrine and fluvial fresh water invertebrates and plants have been recovered from the Borrego, Brawley, and Bautista Formations in the Borrego San Felipe Basin (Remeika, personal communication 1996) and Palm Spring Formation, in the Vallecito Creek/Fish Creek Basin (Taylor 1966, personal communication 1976, 1977,

1982). The identified taxa include charaphytes, bivalves, gastropods, and ostracodes (Quinn and Cronin 1984; Steinmetz, personal communication 1998; Cosma, personal communication 2001).

The oldest terrestrial vertebrates within ABDSP are from the Borrego Buttes. The remains, which include a gomphothere, pseudalurine cat, and small camelid, were recovered from near-shore lacustrine deposits (Jefferson 1999a) that are thought to correlate with the Split Mountain Formation. They predate the Fish Creek Gypsum, and fall in an 11–7 MY age range (Dean 1988, 1996; Kerr and Abbott 1996, Jefferson 1999a).

The late Miocene through mid-Pleistocene Layer Cake, Arroyo Seco, and Vallecito Creek vertebrate assemblages occur in a superposed, conformable biochronological sequence (see Downs 1957, 1965, Remeika et al. 1995, and Cassiliano 1999). The Layer Cake assemblage (Hemphillian and early Blancan NALMA) falls within the Gilbert Magnetochron, and ranges between about 4.0 and 3.4 MY. The Arroyo Seco assemblage (mid-Blancan NALMA) directly follows the Layer Cake assemblage at about 3.4 MY. Volcanic ash fission track analyses (Johnson et al. 1983) place the transition between the Arroyo Seco assemblage and the following Vallecito Creek assemblage before the end of the Gauss Magnetochron at  $2.3 \pm 0.4$  MY. The Vallecito Creek assemblage (late Blancan through mid-Irvingtonian NALMA) falls within the Matuyama Magnetochron, and ranges from the base of the Matuyama to the Jaramillo Magnetosubchron, or from about 2.3 to 0.9 MY. For a discussion of the Vallecito Creek/Fish Creek faunal sequence and chronology, see Downs and White (1965), Johnson et al. (1983), Opdyke et al. (1974, 1977), Lindsay et al. (1987), Lundelius et al. (1987), Lindsay and White (1993), Jefferson (1999b).

The Borrego Local Fauna (Remeika and Jefferson 1993) (Irvingtonian NALMA) ranges in age from about 1.25 to as young or younger than 0.37 MY (Remeika and Beske-Dehl 1996, 1998). This faunal assemblage overlaps chronologically with the upper range of the Vallecito Creek assemblage, and falls within the Matuyama and Brunhes Magnetochrons. The Ocotillo Conglomerate stratigraphic section also includes the Bishop Tuff, dated at about 0.76 MY (Rymer 1991, Sarna-Wojcicki, personal communication 2001).

#### **Paleontological Sensitivity Map (see Figure 7.4)**

Paleontological sensitivity maps are a standard paleontological resources management tool, and display the potential of delimited areas to produce fossils of varying significance and/or abundance. Generally, these areas are restricted to the outcrop patterns of specific geological formations or members of formations. Within ABDSP, these mapped geological units include all, or portions of, the Anza Formation, Bautista beds, Borrego Formation, Brawley Formation, Canebrake Conglomerate, Imperial Formation, Ocotillo Conglomerate, Palm Spring Formation,

Quaternary Alluvium, and Split Mountain Formation. Although much of the outcrop patterns of some of these units (e.g., The Split Mountain Formation or Quaternary Alluvium) are not included on the Sensitivity Map, all sedimentary deposits in ABDSP have minimal fossiliferous potential.

The potential degree of sensitivity for areas on the Sensitivity Map is ranked at the following levels: (1) *High*, (2) *Medium*, (3) *Low*, and (4) *Unknown/potentially High*. Some areas of ABDSP have yet to be examined at a reconnaissance level and their sensitivity is difficult to assess. Also, it is possible that geological formations ranked as having a low potential, based on current data, may yield significant fossil remains. Areas mapped as having a *High* sensitivity are those where significant fossil remains are known to occur. Areas with a *Medium* sensitivity are those where fossils of medium to low significance are abundant, or areas where significant fossils are rarely found. Areas ranked as *Low* sensitivity are those where fossils of high or low significance are rarely found or locally absent. Areas included in the *Unknown/potentially High* category include mapped outcrops of geological formations that have not been assessed or surveyed, and those that, where surveyed, yield significant remains.

#### 2.2.2.2 *Significant Biota*

An amazing diversity of plant and animal life is integrated with the physical environment of ABDSP. Even the most commonly seen plants and animals of this Park display amazing expressions of morphology, behavior and physiology; features that depict their adaptation to and dependence on the diverse and often extreme forces of the region. This diversity is unmatched in the California State Park system.

##### *Plant Communities and Wildlife Habitats*

The California Department of Fish and Game (CDFG) conducted a vegetation mapping study of the Park and adjacent region (Keeler-Wolf et al. 1998). The methodology employed reflected the protocol outlined in United States Geological Survey (USGS) *Field Methods for Vegetation Mapping* (1997). In total, a 928,090-acre area was mapped and 96 vegetation series were defined according to the *Manual of California Vegetation* (MCV) (Sawyer and Keeler-Wolf 1995). These vegetation series have been compared or “cross-walked” to other plant community identification systems yielding 59 series as recognized by Holland’s 1986 classification, and 26 wildlife habitats as defined by CDFG’s California Wildlife Habitat Relationship System (CWHR) (Keeler-Wolf et al. 1998).

Although the vegetation map and the CWHR are important management tools for addressing specific issues involving species and habitats throughout the Park, a more general habitat characterization is beneficial for dealing with broader, more general park management issues. The “Generalized Habitat Map” (Figure 7.5)

depicts the distribution of broad habitat types found throughout ABDSP. This map was produced by analyzing each of the mapped vegetation series. An ecological



assessment of each vegetation series was included with the 1998 vegetation mapping product. This assessment was simplified and in general, each vegetation series and/or dominant species within those series were analyzed for their typical environmental setting. The series were grouped into five broad categories: Washes, Arroyos and Adjacent Terraces; Wetland and Riparian Areas; Open Desert Scrub; Montane; and Transition Zone.

***Washes, Arroyos, and Adjacent Terraces:*** Washes, arroyos, and terraces constitute the dry stream channels and closely associated banks and floodplains found in the lower elevations of ABDSP. Washes and arroyos may sustain ephemeral surface flows during the winter and spring periods, but typically only during intense rainfall events. Common perennial plants of this habitat include Smoketree, Desert Willow, Tamarisk, Cheesebush, Desert Lavender, Honeybean Mesquite, Screwbean Mesquite, Ironwood, Catclaw, and Blue Palo Verde.

The desert washes and adjacent terraces are dynamic environments shaped by the scour of flood and wind. They support an immense diversity of plants and animals, species that are often dependant on the natural processes of the wash. Of the Park's many habitats, its desert washes and terraces are among the most heavily used by the variety of visitors that frequent the Park. Highway-legal vehicles, equestrians, mountain bikes, hikers, and campers are common in many washes. The long-term effect of this recreation on soil stability, vegetation, and wildlife communities is largely unknown.

***Wetland and Riparian Areas:*** Wetland and riparian areas within the Park are complex, often composed of a diverse assemblage of hydric soils, substrates, and plant species and communities associated with multiple types of surface and subsurface waters. Perennial plants such as Willow, Cottonwood, Fan Palm, Sycamore, Arrowweed, White Alder, and Mule Fat are found throughout these areas. Wetland and riparian areas of ABDSP are highly significant and are addressed in detail in "Sensitive Habitats."





**Open Desert Scrub:** Open Desert Scrub is the most common habitat within the Park, occupying the vast expanses of the desert floor, bajadas, lower elevation hills and slopes, and xeric mountains. Perennial plants found in this habitat include Creosote Bush, Ocotillo, Mojave Yucca, Nevada Ephedra, Burrobush, White Rhatany, Brittlebush, Desert Sunflower, Teddybear Cholla, Gander's Cholla, Wolf's Cholla, Silver Cholla, and California Barrel Cactus.



**Montane:** The mountainous terrain along the western boundary of ABDSP provides a relatively cool and moist climate that supports expanses of forest, woodlands, and meadows, commonly referred to as "montane" habitat. Areas around Buck Ridge, Combs Peak, Ysidro Peak, Granite Mountain, Chariot and Oriflammme Mountains, and Sombrero Peak hold the most significant portion of this habitat and support montane shrub and tree species such as Manzanita, Black Oak, Interior and Coast Live Oak, Mountain Mahogany, California Bay, and Coulter Pine. The mountainous terrain leads down through drainages and swales to open meadows, supporting montane riparian areas, grasslands, and vernal-pool-associated species such as Cuyamaca Larkspur and Cuyamaca Rockcress. The Montane habitat's greater precipitation and cooler temperatures support species not typically associated with a "desert park"; it offers an array of experiences for the park visitor vastly different from those of the desert floor. This habitat is closely tied to and often associated with the Transition Zone.

**Transition Zone:** The habitats that are collectively referred to as the "Transition Zone" occupy significant portions of the Peninsular Ranges and the majority of the Park's western border, extending eastward on the Pinyon, Vallecito, and Santa Rosa Mountains. The transition zone occurs at moderately high elevation and in the rain shadow of the coastal ridges. This location affords cooler temperatures and higher precipitation than the lower desert habitats but is more xeric than montane and other habitats at similar elevations on the west slope of the Peninsular Ranges. The transition zone is generally made up of chaparral, pinon-juniper woodland, and semi-desert succulent scrub. Transition zones are typically diverse in species and physical structure owing to the large changes in habitats within short distances. Numerous species associations can occur within the transition zone including various combinations of Redshank, California Juniper, Desert Apricot, Chamise, Sugarbush, and species typical of the lower desert (e.g., Brittle Bush, Mojave Yucca, Desert Agave, California Barrel Cactus, and Beaver-tail Cactus).

The expanses of high country, with transition to desert floor, are a major force behind the outstanding biodiversity of this Park. Edge impact, trespass, and fire management issues are perhaps most dramatic throughout these regions.

### Plants

There are a total of 932 plant taxa belonging to 387 genera in 98 different families that are documented within the boundaries of the Park. The plant family with the greatest representation is the Asteraceae (sunflower) family with 135 taxa, followed by the Fabaceae (pea) family with 77 taxa and the Poaceae (grass) family with 63 (CSP 2002).

ABDSP is world-famous for its extensive spring wildflower bloom. During years with specific meteorological conditions, a diverse array of wildflowers will emerge, lending the full spectrum of color to desert floor, washes, bajadas, and uplands. A good wildflower year can draw one-third of a million more visitors to ABDSP, when compared to poor wildflower years. The wildflower blooms of ABDSP stand prominent among events that inspire a sense of wonder and respect for wild nature.



***Creosote Bush and Mojave Yucca:*** Creosote Bush and Mojave Yucca are long-lived perennial plants that are currently common throughout the open desert scrub habitats of the Park. These species express a “clonal ring” growth pattern in which one genetic individual will spread from a center point. Work by Vasek (1995) in the Mojave Desert has produced age estimates for a single living Creosote to 11,700 years. This places the largest Creosote rings as the oldest forms of life known to man. Similar work with Mojave Yucca has dated individuals to 2,250 years. Although these species do not have an official sensitivity listing, management actions should recognize their unique nature as long-lived individuals, and ensure their protection.

***Mycrophyll Woodlands and Large Woody Perennials:*** In some situations, typically in association with sandy or gravelly arroyos, species such as Desert Willow, Smoke Tree, Blue Palo Verde, Catclaw, Box-thorn, Ironwood, Honey Mesquite, Screw-bean Mesquite, Desert Lavender, Chaparral Broom, Desert Fragrance, Spiny Senna, Pink Fairy Duster, and Pig Nut will contribute to an open to dense mixing of vegetation often referred to as a mycrophyll woodland. Desert microphyll woodlands (or dry wash woodlands) are moderately tall structured (30-60') and feature several species of drought-deciduous, microphyllous species. These woodlands occur primarily in coarse-textured soils of washes and arroyos in the lower Mojave and Colorado



deserts. This vegetation is similar to other desert alluvial or riparian scrubs but is more diverse in structure.

Water and nutrient limitations of desert ecosystems have contributed to the development of vegetation communities with a relative scarcity of trees and other large woody perennial plants. However, where these plants do exist, they contribute essential functions such as structure, shelter, and nutrient cycling. Microphyll woodlands and large woody perennials also provide an attractive character for park visitors. Large trees or shrubs provide inviting places for campers, although excessive and repetitive camping at the base of these plants may have adverse effects on their survival. Illegal harvest by Park visitors for firewood is also an issue. Currently, some primitive roads lie within microphyll woodlands in ABDSP and may have an adverse effect on the integrity of these special regions.

### **Animals**

***Invertebrates:*** The invertebrate fauna of ABDSP is immense in biomass and diversity. Many of these creatures remain a mystery and the extent to which they contribute to the ecological health of the desert is relatively unknown.

ABDSP supports a diverse scorpion population, with 17 different species from eight families documented within its perimeter. These terrestrial invertebrates occur in a variety of habitats within the Park, including desert brush areas and washes, rocky terrain or crevices of cliff faces, fine sand, and even the higher altitude areas such as in the Laguna Mountains. The Giant Desert Hairy Rock Scorpion, Yellow Sand Scorpion, Silvestri's Mountain Scorpion, Yellow Ground Scorpion, Little Crevice Scorpion, and the Swollen-tail Scorpion are some of the more common species found in ABDSP (Soleglad 2002).

ABDSP is well known for its diversity of butterflies. As many as 116 species of butterflies can be found in the Park, and among those, 20 are considered abundant or common. Species such as the California Giant Skipper, the Tiny Checkerspot, and the Small Blue have the majority of their U.S. ranges within the Park (Levy 1998).

Among terrestrial invertebrates, ants are well known for their soil excavation and organic material collection activities that aid plants in obtaining water and nutrients. It is estimated that ABDSP has between 50 and 70 species of ants (McKenzie 1997).

The Colorado Desert is home to a diverse assemblage of terrestrial mollusks. These "land snails" are typically associated with rock falls and land slides. Their movement is fairly restricted and this is thought to have contributed to the evolution of unique subspecies and populations in many canyons throughout ABDSP.

As many as 130 taxa of aquatic invertebrates have been documented in the aquatic habitats of the Park (Herbst et al. 1995); although some of the taxa within the Park represent geographically widespread groups, others represent a characteristic Colorado Desert native fauna. Mayflies, Stoneflies, Hellgrammites, Dragonfly Nymphs, and Caddis larvae are commonly found. Among the more notable aquatic invertebrates documented in the Park are Elmid Riffle Beetles of the genus *Microcylloepus*, Hydrobiid Snails, the Dragonfly Nymph (*Cordulegaster dorsalis*), and larvae of *Blepharicerids* or Net-Winged Midges.

Five species of Branchiopods have been documented in the Park. They represent the order Anostraca (Fairy Shrimp and Brine Shrimp), Conchostraca (Clam Shrimp) and Notostraca (Tadpole Shrimp). These Branchiopods have been documented in Clark Dry Lake, Blair Valley, and Little Blair Valley (see “Sensitive Habitats, Desert Ephemeral Playas”).

**Amphibians:** Currently, 14 species of amphibians have the potential to exist within ABDSP. Eight of these have been documented, with Pacific Tree-frog, California Tree-frog, Western Toad and Red-spotted Toad being the most commonly encountered (CSP 2002; USGS 2000). These species may be found in the larger creeks and canyons, especially those with standing or flowing water and well developed wetland and riparian areas. Some species such as the Arboreal Salamander and the Garden Slender Salamander are typically restricted to the montane and transition areas of the Park, and associated with wet drainages and meadows, woodlands, and chaparral.

Within ABDSP, amphibians are primarily restricted to isolated wetlands within a predominantly xeric environment, creating a situation where individual populations are extremely susceptible to extirpation due to human intrusion, exotic species, or stochastic influences (USGS 2000).

**Reptiles:** 31 taxa (28 species, 3 subspecies) of lizard, 28 taxa (24 species, 4 subspecies) of snake, and 1 tortoise species have the potential to occur within the boundary of the Park (CSP 2002). Of these 60 taxa, only nine remain to be documented through surveys. Some of the reptiles that are common to the Park or are characteristic of the area include the Desert Iguana, Zebra-tailed Lizard, Side-blotched Lizard, Granite Spiny Lizard, Chuckwalla, Whiptail, Red Diamond Rattlesnake, Colorado Desert



Sidewinder, Arizona Glossy, Coachwhip, California King Snake, and Sonoran Gopher Snake.

The occurrence and distribution of the variety of species and subspecies of reptiles within ABDSP is largely dependent upon the unique characteristics of the Colorado Desert, as well as its physical relationship with the Mojave and Great Basin Deserts to the north and the coastal environment to the west. The integration of these environments supports a truly unique reptilian assemblage. This pattern of reptile distribution provides important information for understanding the forces of evolution and adaptation (Stebbins 1995).



**Birds:** The number of bird species found in the California Desert is greater than the number of mammal, reptiles, amphibians, or fish (England and Laudenslayer 1995). This diversity is especially exceptional due to the limited extent of wetlands, ponds, and lakes. Currently, a total of 297 species of birds have been documented in ABDSP, with 100 species representing a typical Christmas Bird Count for the Park (CSP 2002; P.

Jorgensen, personal communication 2002). Due to this diversity and the importance of the Park for the survival of many bird species, ABDSP has been designated a Globally Important Bird Area by the American Bird Conservancy (July 26, 2001).

The suite of bird species present in the Park at any particular time is extremely variable. Over 50 different species live year round in ABDSP; among these residents are the Gambel's Quail, White-winged Dove, Say's Phoebe, Phainopepla, Cactus Wren, and the Common Raven. However, other species such as Swainson's Hawk, Vaux Swift, Rufous Hummingbird, and Willow Flycatcher may only migrate through the Park in the spring or fall. Some species such as Sharp-shinned Hawk, Northern Flicker, Western Bluebird, and Yellow-rumped Warbler will typically over-winter in the Park, while others such as Lesser Nighthawk, Least Bell's Vireo, Lucy's Warbler, and Hooded Oriole only come to the Park to breed (CSP 2002; Jorgensen, P. personal communication 2002; Massey 1998). This avian diversity, rich in taxa, widely distributed, and variable throughout seasons, is perhaps one of the finest examples of the complexity encountered when incorporating species conservation into Park management.

Although many species of birds employ a wide range of effective techniques to manage their body water content and temperature, ample and undisturbed sources of surface water and wetland and riparian areas are critical elements for avian survival and diversity within the Park (England and Laudenslayer 1995).

**Mammals:** The order Rodentia is the largest mammalian order in ABDSP, represented by five families within the Park. A total of 31 species of rodents are present and 18 of those are fairly common. ABDSP is also home to at least 11 species of bats and several species of shrew and mole (CSP 2002). White-tailed Antelope Ground Squirrel, San Diego Pocket Mouse, Desert Kangaroo Rat, Cactus Mouse, Desert Woodrat, House Mouse, and Western Pipistrelle are among the most commonly encountered small mammals. Small mammals are present in virtually all habitats in the Park. They depend on and contribute important functions to soil and vegetation processes (Bainbridge and Virginia 1995; Reichman 1991), and constitute an essential prey source for many larger carnivorous animals.

Other mammals found within the Park include Virginia Opossum, Brush Rabbit, Desert Cottontail, Black-tailed Hare (Jackrabbit), Kit Fox, Gray Fox, Ringtail, Raccoon, Long-tailed Weasel, American Badger, Western Spotted Skunk, Striped Skunk, and Bobcat.

Large mammals documented in ABDSP include the Coyote, Mountain Lion, Peninsular Bighorn Sheep, Southern Mule Deer, Black Bear, and the feral Horse. For most large mammals, the size of the Park and its diversity of habitats are extremely important. A unique character of large mammals, and especially the Bighorn Sheep, feral Horse, and Mountain Lion, is the extent to which they stimulate public interest. Possibly, more so than any other animal grouping, large mammals contribute an element of social complexity to Park management.

#### **2.2.2.3 Sensitive Biota**

The following summary presents the sensitive habitats, plants, and animals of ABDSP. Specific taxa that are currently designated Threatened or Endangered, or taxa and habitats that are known to be rare, in decline, or exceptionally significant, are discussed and may require more in-depth consideration in management decisions. The “Plant and Animal Sensitivity Codes” (Table 6.3) provide a brief description of the sensitivity listings and abbreviations used for sensitive habitats, plants, and animals throughout this text.

#### **Sensitive Habitats**

A variety of rare and highly sensitive habitats are present throughout ABDSP. These sensitive habitats demand a higher level of management attention and are briefly discussed below.

**Riparian:** Desert riparian areas are typically composed of several vegetation series and associations including species such as Red Willow, Arroyo Willow, Cottonwood, Desert Fan Palm, Desert Grape, and White Alder. Perennial shrub species Mulefat, and Arrow Weed are also fairly common. Annual and perennial herbs such as Cattail, Tule, and Scratchgrass are common within the more wet portions of this habitat. Desert riparian can be found along portions of Coyote, San



Felipe, Vallecito and Carrizo Creeks and their associated tributaries, typically where large springs or other substantial surface flows persist.

ABDSP supports some of the highest quality riparian areas in the Colorado Desert. Lower and Middle Willows of Coyote Canyon are designated Significant Natural Areas in the California Natural Diversity Database (CNDDDB) and Upper Willows is expected to receive this designation in the future. San Felipe, Vallecito, Carrizo, and Fish Creeks all flow into the major ciénagas of the western Colorado Desert. Preservation of the ecological connectivity between these wetland complexes is a major issue to be considered in all planning efforts throughout the region. Desert riparian areas support significant

amounts of habitat types ranked in the CNDDDB as rare or sensitive. Those habitats and their sensitivity rankings include Sonoran Cottonwood Willow Riparian Forest (G2/S1.1), and Mojave Riparian Forest (G1/S1.1)(CDFG 2002).

Highway S2 provides a major source of negative impact to San Felipe Creek and associated wildlife and habitat. Off-highway vehicular recreation presents another negative impact that has long been a concern for the integrity of desert riparian areas, especially those of Coyote Creek. Park staff has worked to remove all roads from perennial flows and associated riparian habitat while maintaining public access. Regions where roads encounter associated ephemeral surface water, remain an issue. Tamarisk invasion is also a major concern for riparian areas in ABDSP (see “Exotic Species”).

Montane riparian areas are found in the high country of the coastal mountain range. They are dominated by willow, cottonwood, and oak species. Roads, equestrian and bike trails, and foot traffic may erode this habitat, assisting in the establishment of invasive exotics and decreasing water quality and quantity in low-flow summer stream systems. The coastal mountains of San Diego County are extremely popular with equestrians. Equestrian trails, staging areas, horse waste, and the equestrian-associated spread of exotic vegetation are major issues involving the montane

habitats, especially riparian, meadow, and vernal pool areas. Parish's Meadowfoam is among the sensitive species that may be found on the upper slopes and damp terrain associated with this habitat.

**Palm Oases:** Palm oases are distinctive riparian woodlands with the Fan Palm as the sole or dominant tree in the canopy. Other species potentially present include Willow, Sycamore, Oak, and Cottonwood. Within ABDSP, palm oases typically



emerge from narrow canyons or other regions with perennial water or intermittently flooded and saturated soils. Roughly 30 palm oases have been documented within the Park, with Borrego Palm Canyon, Mountain Palm Springs, Sheep Canyon, and Cougar Canyon among the most well known and heavily visited.

The narrow, steep-walled canyons that encompass many palm tree oases

concentrate visitors in the perennial water sources and associated sensitive microhabitats. Direct visitor impacts to this habitat and displacement of wildlife are major issues, especially at Borrego Palm Canyon as well as Pygmy and Southwest groves of Mountain Palm Springs. Illegal campfires and arson have burnt several groves in the past. Hiking and climbing along unstable canyon walls may increase erosion and negatively effect surface water quantity and quality.

These unique environments were the primary inspiration for the purchase of state park land in the Colorado Desert. The character, charm, and cultural significance of the palm oases attract large numbers of visitors. Desert Fan Palm Oasis Woodland is ranked as G3/S3.2 in the CNDDDB (CDFG 2002). Among the many sensitive species that rely on this environment is the Western Yellow Bat.

**Mesquite Bosque:** The deep rooting mesquite take advantage of subsurface moisture and therefore are typically associated with upper or outer "perimeter" portions of desert surface water and often in regions where surface water is rarely seen. Some of the most significant mesquite bosques in ABDSP are found along portions of Coyote, San Felipe, Vallecito, and Carrizo Creeks. This nitrogen-fixing legume provides important functions for cycling nutrients through the desert ecosystem. Mesquite Bosque is ranked G3/S2.1 in the CNDDDB (CDFG 2002).

Negative consequences arising from the depletion of regional groundwater are perhaps most apparent in the mesquite bosque habitat. Mesquite bosques that once thrived have shown a trend toward disappearance; this trend is positively correlated

with reduction of groundwater levels. In addition, mesquite bosques are popular camping areas, providing privacy as well as protection from the wind and sun. The extent to which this camping activity may negatively affect this important habitat remains to be assessed.

***Ciénagas (Alkali Marshes):*** These freshwater wetlands result from sizable ponding of surface water with extensive development of hydrophytic vegetation such as Cattail, Tule, and Willows. In the western Colorado Desert of southern California, there are three critically important ciénagas, of which, Sentenac Ciénaga and Carrizo Marsh lie within the Park. San Sebastian Marsh lies downstream of the confluence of San Felipe, Carrizo, and Fish Creeks and is managed by the BLM.

Ciénagas are extremely important for the support of the region's biodiversity and may play an important role in dispersing the powerful desert floods (Herbst et al. 1995). Ciénagas support significant amounts of habitat types ranked in the CNDDDB as rare or sensitive. Those habitats and their sensitivity rankings include Sonoran Cottonwood Willow Riparian Forest (G2/S1.1), and Mojave Riparian Forest (G1/S1.1)(CDFG 2002).



The newly acquired Sentenac Ciénaga provides an excellent example of ecologically damaging human uses of the land. Cattle have been raised on this wetland since the late 1800s. Around 1990 the wetland was burned in an attempt to improve cattle production. These activities are thought to have resulted in a massive invasion of Tamarisk. Current and future restoration of the natural processes associated with this ciénaga will provide significant benefits to the region's biota.

***Montane Vernal Pool and Meadow:*** Montane vernal pool and meadow habitat is associated with topographic depressions in surrounding forested areas that have moist to wet soils. These areas are comprised mostly of grasses and other herbaceous species, and often encompass swales and other drainage features. The most significant portion of this habitat within ABDSP is found at Cuyamaca Lake, within the Lucky 5 Ranch. This meadow and vernal pool complex is inhabited by both native and non-native grass species and various spring- and summer-flowering wildflowers.



Portions of the Cuyamaca Lake basin represent the vestige of a unique montane habitat. Within San Diego County, 97% of the vernal pool habitat has already been lost (Bauder, personal communication 2002), necessitating a high level of protection for the portions of this habitat that remain. The San Diego County Water District owns the southern area of Cuyamaca Lake. This portion is perennially flooded through the pumping of groundwater, and used as a recreational lake. In ABDSP, at least four species of sensitive plants are found in or closely associated with this habitat including Cuyamaca Larkspur, Lake Cuyamaca Downingia, Cuyamaca Rock Cress, and Parish's Meadowfoam.

***Desert Ephemeral Playas:*** These playas are typically identified as large flats of dry clay soil, sparsely vegetated, with a slight concave depression. The relatively impervious clay soils hold accumulated run-off, which fills the playas only during the heaviest rain years. Clark Dry Lake, Blair Valley, and Little Blair are the most significant desert ephemeral playas in the Park.



These apparently lifeless expanses are loaded with the cysts of aquatic invertebrates (branchiopods) that lay dormant and hatch only when the waters of the playa will support their brief period of activity. Each ephemeral pool often has a unique chemical and physical environment and plants and animals of these environments are prone to endemism (Eng et al. 1990).

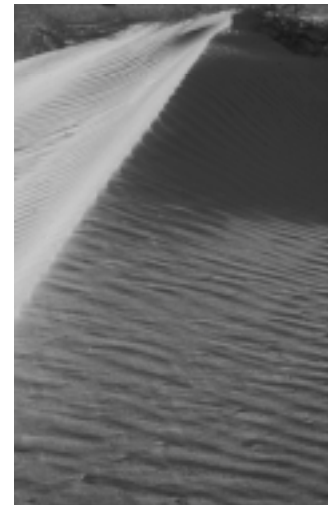
The playas are extremely sensitive to disturbance. The surface soils are easily broken by foot and vehicular traffic, leaving tracks that remain visible for years. The broken playa surface is susceptible to wind erosion, which may act to disperse shrimp cysts to regions of the desert where they will never hatch. Furthermore, branchiopod cysts can be destroyed with forces of less than one newton (Hathaway et al. 1996). Borrego Valley peppergrass is a sensitive species that depends on the ephemeral lakes of Blair Valley and Little Blair Valley.

***Small Springs and Seeps:*** A spring is a concentrated discharge of groundwater appearing at the ground surface as a current of flowing water, and a seep is a slow movement of groundwater to the ground surface (Todd 1980). There are nearly 100 springs and seeps in the Park with such names as Rattlesnake, Stuart, Cottonwood, Pinyon, Big, and Dos Cabezas. Although many of the larger riparian and palm grove areas are technically associated with a spring, the majority of springs and seeps within ABDSP are smaller and more isolated expressions of surface water.

As described by Hebst (1995), “Springs are often the only permanent remnants of once more extensive waters that covered much of the region, and are refuges to isolated, often genetically distinct, populations of taxa that were formerly widespread...spring source waters contrast with ephemeral lakes and streams in that thermal, chemical, and flow conditions are relatively constant. Such springs provide some of the few stable aquatic habitats available in the desert.”

These isolated pockets of water are important focal points for biodiversity and support many plant and wildlife species throughout this xeric environment. They may also provide water for thirsty desert travelers. This combination of qualities makes them high profile management areas. Parish’s Meadowfoam is among the sensitive plant species known from springs and seeps within the montane habitat of ABDSP.

**Sand Dune:** Within the Park, sand dune systems are found at the east side of Clark Lake, the west side of the Borrego Badlands in the Ant Hill area, and in the Blow Sand Canyon area of the Borrego Buttes. Most of these dune systems approach or exceed a square mile in area. The dune field west of the Borrego Badlands grows and recedes as individual dunes move to the southeast. The fields in Clark Lake and Borrego Buttes are for the most part stationary.



In general, a surface crust protects the subsurface environment of the dune creating underground microhabitats with elevated soil moisture and decreased temperatures. Sand dunes are active systems, often supporting dependant plant and animal assemblages. The Colorado Desert Fringe-toed Lizard is a sensitive species known to utilize this habitat.

Activities such as foot traffic disturb the dune’s protective surface layer and compromise the integrity of this habitat. Saharan Mustard is an aggressive exotic plant that has invaded sandy soil habitats throughout the Park and may negatively affect natural dune dynamics.

**Significant Wildflower Areas:** Significant wildflower areas are a relatively diverse assemblage of habitats, but typically encompass wide sandy washes, terraces, and desert floor regions. The most outstanding wildflower areas are most commonly found in association with disturbed sandy substrates; often enhanced by the processes of flood and wind. Some of the most popular wildflower regions are located in the alluvial deposits of Coyote Creek near the town of Borrego Springs, as

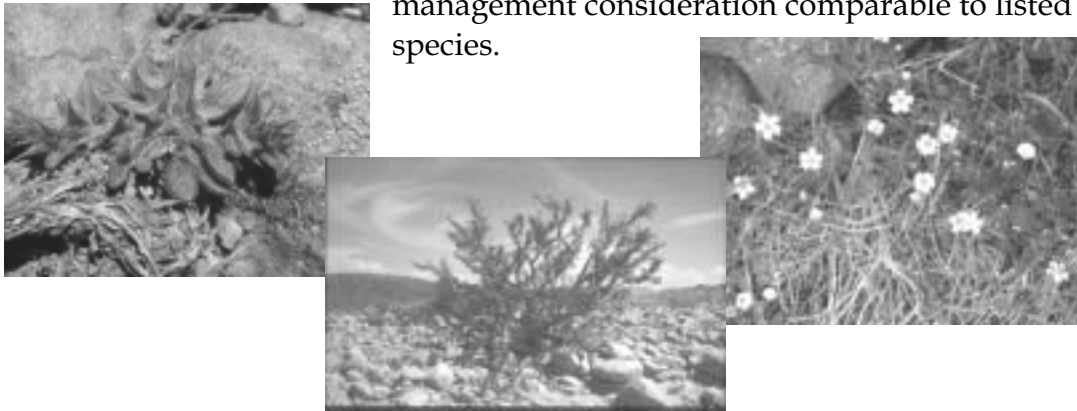
well as along the roadside of County Highway S2 in the southern portion of the Park.

The wildflower blooms of ABDSP stand prominent among events that inspire a sense of wonder and respect for wild nature. A good wildflower year can draw one-third of a million more visitors to ABDSP, when compared to poor wildflower years. With such an intensity of use focused on these regions, open camping and hiking are a major concern for this habitat.

### *Sensitive Plants*

Currently, 61 sensitive plant taxa are known to have the potential to occur within the Park (Table 6.4 “Sensitive Plants”). To date, field surveys have documented 42 of those sensitive plant taxa. Two plant species documented in ABDSP are listed as Threatened or Endangered; those species are discussed below. Other species discussed below are those that currently meet the criteria to be listed as Threatened or Endangered but have not received that designation; these species require

management consideration comparable to listed species.



#### **Parish’s Meadowfoam (*Limnanthes gracilis* ssp. *Parishii*)**

**STATUS:** SE; CNPS List 1B; RED 2-2-3

Parish’s Meadowfoam is an herbaceous annual in the Meadowfoam family (Limnanthaceae) that occurs in scattered locations in the moist montane meadows and drainages of the Cuyamaca, Laguna, and Palomar Mountains. The plants are small and produce masses of white flowers in April and May giving the appearance of a foaming meadow. Eight confirmed populations of Parish’s Meadowfoam have been documented within ABDSP. This plant is known to be associated with gently sloping, wet terrain, often in relation to springs or seeps. This is an annual species and its distribution may fluctuate from year to year. Activities compromising the integrity of the wet drainages and springs or seeps may pose a threat to this species.

#### **Cuyamaca Lake Downingia (*Downingia concolor* ssp. *brevior*)**

**STATUS:** SE; CNPS List 1B; RED 3-3-3

Cuyamaca Lake Downingia is an herbaceous annual in the bellflower family (Campanulaceae). This diminutive plant germinates under water in the spring, and

purple flowers appear in May or June after the standing water has evaporated. This species is endemic to the meadows and drainages of Cuyamaca Valley. Activities that compromise the natural processes of this ephemerally flooded habitat may have a negative effect on this species.

**Cuyamaca Larkspur** (*Delphinium hesperium* ssp. *cuyamacae*)

STATUS: SR; CNPS List 1B; RED 2-2-3

Cuyamaca Larkspur is an herbaceous perennial in the buttercup family (Ranunculaceae) with erect leafy stems that produce dense blue-violet blooms in June and July. This species grows in sandy soils in low, moist drainages and swales within grassy meadows along the border of Cuyamaca Lake and surrounding areas.

**Borrego Bedstraw** (*Galium angustifolium* ssp. *Borregoense*)

STATUS: SR; CNPS List 1B, RED 3-1-3

In California, Borrego Bedstraw is only known from the Colorado Desert in San Diego County. Borrego Bedstraw has been found primarily in steep, rocky canyons or on rocky slopes at elevations ranging from 1,345 to 4,068 feet (410–1,240 meters). Within ABDSP, the majority of the plants occur in granitic rocky places, either directly among rocks and boulders, in a mixture of decomposed sand or gravel and rocks, or on rocky cliffs. The largest concentrations of plants have been found in the Culp Valley–Hellhole Canyon area and in the Pinyon Mountain area. Camping and hiking activities present a moderate threat to some populations, particularly those in the Pinyon Mountain and Pinyon Canyon areas.

**Borrego Valley Peppergrass** (*Lepidium flavum* var. *felipense*)

STATUS: CNPS List 1B, RED 3-2-3

Within ABDSP, Borrego Valley Peppergrass is known to occur in the ephemeral lakes of Blair Valley and Little Blair Valley. The majority of these plants are found at the lower, ponding-areas of the lakes although some plants have also been found in the granitic sand and gravel of rocky outcroppings or slopes adjacent to the lakes. Both of these populations may receive considerable foot traffic and are located close to intensely used camping areas.

**Orcutt's Woody Aster** (*Xylorhiza orcuttii*)

STATUS: CNPS List 1B, RED 2-2-2

This plant is found on the southwestern side of the Colorado Desert in San Diego and Imperial counties, as well as to Baja California. Within the Park, the species occurs in a wide variety of settings from flat wash bottoms to steep, nearly vertical rocky cliffs, but nearly always in the proximity of sedimentary-based badlands deposits. Two distinct groups of this species have been documented within ABDSP. One occurs north of State Highway 78, in the vicinity of the Borrego Badlands; and the other south of the same highway, in the general vicinity of Fish Creek and the

Carrizo Badlands. Potential threats to these populations include vehicle activity and competition with non-native mustard (*Brassica* sp.).

**Arizona Carlowrightia (*Carlowrightia arizonica*)**

STATUS: CNPS List 2, RED 3-2-1

Within California, this plant is found along the western edge of the Colorado Desert, mainly in the Borrego Springs and Borrego Palm Canyon areas. Distribution within ABDSP appears limited to canyons along the western edge of the Borrego Valley. Rare plant surveys have documented Arizona Carlowrightia growing along canyon drainages or their associated alluvial fans between 886 and 1,296 feet (270 and 395 meters) elevation. Populations have been found among granitic boulders, growing in a decomposed granite substrate, and often associated with alluvial hummocks containing recently deposited boulders. This plant occurs along regularly used hiking trails and is likely to be impacted by passing hikers.

**Cuyamaca Rock Cress (*Arabis hirshbergiae*)**

STATUS: CNPS List 1B; RED 3-2-3

A newly described species (Boyde 1998), this low growing perennial herb is found on vernal saturated clay soils east of Cuyamaca Lake. This species is only known from Cuyamaca Lake, and therefore, protection of this montane vernal pool habitat is essential for its survival.

**Gander's Cryptantha (*Cryptantha ganderi*)**

STATUS: CNPS List 1B, RED 3-3-2

In California, Gander's Cryptantha is only known from Borrego Valley. This species has been found growing in fine sand of decomposed granitic origin, either of sandy floodplains, dunes and sand fields, or alluvium along wash bottoms. Several populations of Gander's Cryptantha have been documented in the northern part of ABDSP. The largest concentration (more than 1,000 plants) was found along the northern edge of the Borrego Valley, associated with sand carried by both wind and water out of Coyote Canyon. Other populations have been documented at the mouth of Coyote Canyon, at Ant Hill, and on sand dunes northeast of Clark Lake.

**Elephant Tree (*Bursera microphylla*)**

STATUS: CNPS List 2, RED 3-1-1

Elephant Trees are found along the western edge of the Colorado Desert and into Arizona and Baja California. Those Elephant Trees of ABDSP represent the most drought-adapted and northerly member of the genus *Bursera*. There are roughly 10 populations of Elephant Trees in the Park. These plants typically grow on steep granitic talus slopes with a substrate of coarse granitic sand and gravel mixed with rocks.

### *Sensitive Animals*

Based on official surveys, State recognized habitat associations (CWHR), or unconfirmed sightings, 86 sensitive animal species are currently known to have the potential to exist within the Park (Table 6.5 “Sensitive Animals”). Of those 86 species, 50 have been officially documented in the Park and are known to use the park for all or a significant portion of their life; nine of those are listed as Threatened or Endangered. Discussed below are those nine Threatened and Endangered animal species as well as other sensitive animals documented in the Park that necessitate a comparable level of management consideration due to their outstanding local or regional significance.



#### **Quino Checkerspot Butterfly (*Euphydryas editha quino*)**

STATUS: FE

Quino Checkerspot Butterflies occur in San Diego and Riverside Counties as well as in Baja California Norte, Mexico. The habitat of the Quino Checkerspot consists of landscapes with diverse topography and healthy native vegetation including coastal sage scrub, open chaparral, juniper woodland, forblands, and native grasslands. A substantial population is known to occur in the southern tip of ABDSP. The probable sighting of the Quino Checkerspot at Culp Valley (Monroe and Monroe, personal communication 2002) stresses the importance of expanding inventory efforts for this species and recognizing further suitable habitat throughout ABDSP.

Major losses of suitable habitat and the decline of this species have been attributed to urban and agricultural development, invasion of non-native species, habitat fragmentation and degradation, enhanced nitrogen deposition, elevated atmospheric carbon dioxide, climate change, increased fire frequency, and other human-caused disturbances such as off-road vehicle use (U.S. Fish and Wildlife Service [USFWS] 2000a).

The U.S. Fish and Wildlife Service produced *The Quino Checkerspot Butterfly Draft Recovery Plan* in January 2001. Six recovery units have been identified in the Draft Recovery Plan for this species, with one of those (Southeast San Diego Unit) encompassing a portion of ABDSP in the Jacumba Peak region near Interstate 8. The U.S. Fish and Wildlife Service designated Critical Habitat for the Quino Checkerspot on May 15, 2002. The Southeast San Diego Recovery Unit contains the Jacumba Critical Habitat Unit, of which, roughly 450 acres lies within ABDSP.

**Barefoot Gecko** (*Coleonyx switaki*)

STATUS: ST

Within the United States, the Barefoot Banded Gecko appears to be limited to rocky hillsides of the Peninsular Ranges in San Diego and Imperial Counties. Nearly all Barefoot Banded Geckos north of the Mexican border occur within ABDSP, making the Park extremely important for the conservation of this species. This species was first documented in the mid 1970s and therefore, little is known about it. Due to its striking appearance and rarity, poaching is thought to be a major threat to its survival.

**Sandstone Night Lizard** (*Xantusia henshawi gracilis*)

STATUS: CSC

Known only from ABDSP, this species appears to be restricted to eroded sandstone and mudstone of the Truckhaven Rocks and Calcite Mine areas. Due to its rarity, any actions that have a negative effect on individuals or supporting habitat may have serious consequences to the survival of the species. Poaching is currently the main concern for this species.

**Flat-tailed Horned Lizard** (*Phrynosoma mcalli*)

STATUS: CSC; FP; BLMS

Ranging from the Coachella Valley in Riverside to Baja California, the Flat-tailed Horned Lizard is found in habitats of shifting fine sands and mixed clay hardpan, typically with sparse vegetation. Within the Park, this species has been documented in isolated pockets of significant habitat in the Borrego Badlands and Borrego Valley as well as Carrizo Wash east of S2.

Agriculture, development, and intensive off-road vehicle use are known threats to this species. Human disturbance has reduced Flat-tailed Horned Lizard habitat in the U.S. by almost 40%. An interagency group of land managers have worked to conserve this species without listing it as Threatened or Endangered.

The Flat-tailed Horned Lizard Range-wide Management Strategy was prepared in May 1997. This plan identifies the Borrego Badlands Flat-tailed Horned Lizard Management Area, defining over 40,000 acres (162 km<sup>2</sup>) of conservation habitat within ABDSP.



***Desert Endemic Reptiles:*** The Colorado Desert Fringe-toed Lizard, Flat-tailed Horned Lizard, Desert Iguana, Western Chuckwalla, Sandstone Night Lizard, Spotted Western Leaf-nosed Snake, Colorado Desert Sidewinder, Desert Tortoise, and the Barefoot Banded Gecko are all desert endemic taxa, primarily confined to the larger Sonoran or Mojave deserts. Due to the endemism of these species, actions within ABDSP place considerable weight on their future survival. All desert endemics are important components of park management decisions.

**Least Bell's Vireo (*Vireo bellii pusillus*)**

STATUS: SE; FE; PIFWL; MNBMC

The Least Bell's Vireo is a riparian woodland associated species. Its range in California includes dense riparian habitat in San Benito and Monterey Counties, as well as southern California's coastline and western desert riparian habitat, typically found below 2,000 feet (610 m). This species is a strong indicator of riparian habitat quality.

Within the region, Least Bell's Vireos have been recorded at over 20 locations including Coyote Canyon, Borrego Palm Canyon, Yaqui Well, Carrizo Marsh, Hellhole Canyon, Agua Caliente Spring, Canebroke Canyon, Carrizo Creek, San Felipe Valley, Campbell's Grade, Sentenac Canyon, and Vallecito Ciénaga (USGS 2001; Jorgensen 2002). These riparian habitats are critical to the recovery of this species. Since 1993, the number of territorial males (a means of estimating the number of breeding pairs) has ranged from 58 to 108 in the ABDSP region.

Destruction or loss of riparian habitat and parasitism by the brown-headed cowbird (see "Exotic Species") are major threats to this species. The USFWS produced a Draft Recovery Plan for the Least Bell's Vireo in 1998. The USFWS designated Critical Habitat for the Least Bell's Vireo in 1994. This designation encompasses 640 acres (3 km<sup>2</sup>) of the Park in the Lower Willows portion of Coyote Canyon.

**Southwestern Willow Flycatcher (*Empidonax traillii extimus*)**

STATUS: SE; FE

This bird breeds in riparian habitats along rivers and streams or other wetlands. The presence of dense vegetation and close proximity (less than 60 feet or 20 yards) of water or very saturated soil appear to be important breeding requirements. The first Southwestern Willow Flycatchers documented in ABDSP included two nesting pairs at San Felipe Creek in 2002. Previous records exist and are valid but should be attributed to the migrant subspecies "Little Willow Flycatcher", which is not protected as Endangered while in migration.

The USFWS designated Critical Habitat for this species in 1997. These designations have excluded habitats within and closely associated with the Park; however,

wetland and riparian areas within ABDSP support breeding Southwestern Willow Flycatcher, and these habitats have the potential to increase in value to this species upon completion of riparian restoration projects such as the Sentenac Ciénaga tamarisk removal effort.

**Western Yellow-billed Cuckoo** (*Coccyzus americanus occidentalis*)

STATUS: SE, MNBMC, FSS

The first records of the Western Yellow-billed Cuckoo within ABDSP include one each year in 2001 and 2002 at San Felipe Creek. Both observations were made during the nesting season; however, nesting was not confirmed. Activities that compromise the riparian areas may be a threat to this species.

**Sensitive Breeding Birds:** In addition to the species above, Summer Tanager, Vermilion Flycatcher, Brown-crested Flycatcher, Crissal Thrasher, La Conte's Thrasher, Bendire's Thrasher, Loggerhead Shrike, Gray Vireo, Yellow-breasted Chat, Cooper's Hawk, Prairie Falcon, Golden Eagle, Burrowing Owl, Long-eared Owl, and California Spotted Owl are all sensitive species that have been documented breeding within ABDSP (CSP 2002; P. Jorgensen, personal communication 2002). Although these species are not listed as Threatened or Endangered, the State and Federal governments recognize them as in decline. Their use of the park for breeding is highly significant for the conservation of these species.

**Peninsular Bighorn Sheep** (*Ovis canadensis cremnobates*)

STATUS: ST; FE; DFG

Peninsular Bighorn Sheep occur in the Peninsular Ranges, from the San Jacinto and Santa Rosa Mountains, south to the Jacumba Mountains in San Diego County. They are also found in Baja California, Mexico. Typical habitats of this species include: Sagebrush, Bitterbrush, Pinyon-juniper, Palm Oasis, Desert Riparian, Desert Succulent Shrub, Desert Scrub, Montane Chaparral, and Grassland. Bighorn Sheep prefer open areas of low growing vegetation and require undisturbed sources of surface water. When its time to give birth, rest, and evade predators, they remain close to steep, rugged terrain. Generally, the Peninsular Bighorn Sheep are found at elevations from near sea level to almost 6,000 feet (1,829m) in the mountainous areas of the Park.

Survey data indicate that currently the Bighorn population throughout this region consists of roughly eight ewe groups, with this fragmentation attributed to natural breaks in suitable habitat as well as human developments such as urban growth and paved roads (Rubin et al. 1998). The same study also showed the population of the majority of the ewe groups to be in decline by as much as 28% throughout the mid 1990s.

It is estimated that 75% of the total U.S. population of Peninsular Bighorn Sheep reside within the Park boundary. Major threats to this species include disease, predation by Mountain Lions, and loss and fragmentation or disruption of important habitats (e.g., lambing and feeding areas, escape terrain, water sources, travel routes). Effective conservation tactics should focus on a regional approach while incorporating the identity and dynamics of individual ewe groups (Rubin et al. 1998).

This species was designated Endangered in May 1998. The USFWS produced *The Recovery Plan for the Bighorn Sheep of the Peninsular Ranges* in October 2000. Critical Habitat for this species is defined and encompasses nearly 435,000 acres of ABDSP. This Critical Habitat Designation and its influence on Park operations and visitor activities will remain a constant management issue.

**Bats:** ABDSP provides habitat to support 14 sensitive bat species. Because this constitutes over half of the bat species known to occur in the State, ABDSP is critical for bat conservation in California. To date, 11 bat species have been documented in the Park through specific bat surveys, and of those, California Leaf-nosed Bat, Small-footed Myotis, Long-legged Myotis, Western Yellow Bat, Townsend's Big-eared Bat, Pocketed Free-tailed Bat, Western Mastiff Bat, and Pallid Bat are all Species of Special Concern. Bats roost throughout the day in rock shelters, caves, cliff crevices, tree hollows, palm trees, or buildings; emerging at night to feed on insects. Protection of roosting structure and the ecological systems that provide their prey-base are important considerations for conserving bat populations in the Park.

#### **Introduced Protected Animals**

Populations of the unarmored Threespine Stickleback, Desert Pupfish, Mojave Tui Chub (see "Extirpated Species") and Desert Tortoise have been introduced to ABDSP. These species are recognized as either Threatened or Endangered; however, they are not native to ABDSP and therefore present interesting management issues. The significance of these populations in relation to Threatened and Endangered species conservation efforts should be assessed. Similarly, the extent to which these species negatively affect the native species and processes should be investigated.

#### **Unarmored Threespine Stickleback    (*Gasterosteus aculeatus williamsoni*)**

**STATUS:** SE; FE; DFG

Historically, the Unarmored Threespine Stickleback occurred at the headwaters of the Santa Clara and at low gradient parts of the Los Angeles, San Gabriel, and Santa Ana Rivers. CDFG introduced individuals to Sentenac Canyon in 1972 and 1973, and a population appears to be persisting in the lower part of San Felipe Creek (USGS 2000).

Although the Unarmored Threespine Stickleback is an extremely sensitive species, it is not native to the Park and the extent to which it may negatively affect the aquatic systems of the Park is unknown. Further reintroductions of this fish to functional ecosystems of the Park are not recommended. The conservation value of the existing San Felipe Creek population should be evaluated and removal or management actions developed in conjunction with USFWS and CDFG.

**Desert Pupfish (*Cyprinodon macularius*)**

STATUS: SE; FE

In general, Desert Pupfish are found in ciénagas, springs, small streams, and along the margins of larger bodies of water in the desert regions of the southwestern U.S. Native populations exist at Quitobaquito Spring in southern Arizona, Salt Creek at the Salton Sea and San Sebastian Marsh in San Felipe Creek on Bureau of Land Management land. A native population lived in Fish Creek within ABDSP but was extirpated by flood events of 1916.

Desert Pupfish collected from the Salton Sea and San Felipe Creek were placed in artificial conservation ponds within the Park in 1978, 1979, and 1981 in an effort to establish secure habitats within the fish's probable historic range. The ponds are located at the Visitor Center, Palm Spring, and Borrego Palm Canyon and are vital to the survival of the desert pupfish. Mixing of these populations within the Park and with other populations in the region is prohibited and should not be attempted without detailed scientific assessment. The *Desert Pupfish Recovery Plan* was produced by USFWS in September 1993.

**Desert Tortoise (*Xerobates agassizii*)**

STATUS: ST; FT; BLMS; DFG

Desert Tortoise habitat includes desert scrub, desert washes, Joshua Tree, and most other lowland desert habitats. In California, this species is distributed throughout the Mojave and Colorado Deserts in the southeastern part of the state from below sea level to approximately 4,100 feet (1,250 m).

Although the desert tortoise occurs naturally within 50 miles of the Park, current data suggest that they are not native to ABDSP, but were brought here by people in the last 50 years. An unknown number of Park visitors have released unmarked previously captive tortoises into the Park, thus making potentially native wild individuals impossible to distinguish from former pets. Dozens of sightings have been documented within ABDSP and this species is known to reproduce at the mouth of Sheep Canyon. The habitat within ABDSP is not thought to be critical to the Desert Tortoise and its importance to the survival of the species should be evaluated. General threats to the Desert Tortoise include off-road vehicle use, development, grazing animals, and diseases contracted from illegally released captive tortoises.

### Extirpated Species

A native population of Desert Pupfish persisted in isolated portions of Fish Creek; however, major flood events in 1916 covered this aquatic habitat with alluvium and extirpated the population. Historically, the Mohave Tui Chub was found only in the Mojave River; however, the CDFG introduced this species into San Felipe Creek in 1939–40 and again in 1972 and 1973. Mojave Tui Chub has not been documented in the Park since the mid 1970s. This species is designated Federal Endangered, California Endangered and Department of Fish and Game Fully Protected Species. Further attempts to reintroduce this species are not recommended.

The California Condor once occupied large portions of the southern United States. There is an active program to restock this species throughout the southwest. In the late 1990s, the ABDSP region was evaluated for release potential and an ideal release point appears to be above Palm Canyon in the Los Coyotes Indian Reservation. In the event that Condors are released, ABDSP would surely constitute a portion of their range.

The Grizzly Bear and Pronghorn are known to have once occupied this range but are now extirpated. Historic records of the Grizzly Bear from this region come from Palomar Mountain, Pine Valley, and the Santa Rosa Mountains, with the last known individual shot in 1908 (Bond 1977). Historically, ABDSP may have constituted the western edge of the Sonoran subspecies of Pronghorn, and the northern edge of the peninsular subspecies of Pronghorn (J. Mogart, personal communication 2002). Among the records of Pronghorn within this region are those from Carrizo Creek and the Campo area; however, this species has been extirpated since the early 1920s (Bond 1977). Potential re-establishment of either of these species within ABDSP will require a detailed feasibility assessment.

#### **2.2.2.4 Exotic Species**

### Exotic Plants

At least 38 exotic plant taxa, constituting 4% of the Park's 932 taxa, have been identified within ABDSP (CSP 2002). Of these, 16 species have a high priority for management due to their potential to alter natural habitats and/or because eradication efforts may have a high success rate. An aggressive exotic plant control program is currently implemented throughout riparian and wetland areas of the Park. The most invasive exotic plant species are discussed below.

**Red Brome, Foxtail Brome** (*Bromus madritensis ssp. rubens*)

A native of Europe, Red Brome was established in California by 1848. This grass is found in open, disturbed places at moderate elevations (below 7,218 feet/2,200 meters). Within the U.S., it occurs from California southward into Baja, and into the eastern states. Relief-plot surveys conducted in 1995 indicate that this species is prevalent throughout the Park (CSP 2002).

An extremely aggressive plant, Red Brome (a winter-spring annual) exhibits early germination and rapid early growth, filling desirable microhabitats before native annual species are able to get firmly established. In late spring and summer, as the *Bromus* dries out, a huge quantity of highly flammable fuel is created, and fire becomes a major threat. Such fires often decimate native species, which have little fire resistance, leaving the habitat open to repopulation and eventual domination by Red Brome. No control measures have been attempted in the Park.

**Wild Turnip, Saharan Mustard** (*Brassica tournefortii*)

A native of North Africa and Central Asia, Saharan Mustard was well established in the Coachella Valley by 1938, and the Imperial Valley by 1947. This extremely aggressive species prefers sandy, lowland habitats of the Sonoran Desert, specifically dunes, interdune troughs, sandy flats, sandy-gravelly washes, and roadsides at elevations usually below 2,625 feet (800 meters).

Saharan Mustard competes heavily with spring annuals for water and especially for space. The amount of ground covered by the rosettes can prevent the germination of native annual seeds that lie beneath them. Once dry, the entire plant becomes a Tumbleweed look-alike, blowing across the desert, leaving a wide trail of seeds. This exotic species is widespread in Borrego Valley, along the sandy edges of Borrego and Carrizo Badlands, and in almost all low-lying sandy areas of the Park.

**African Fountain Grass** (*Pennisetum setaceum*)

A native of South Africa, African Fountain Grass was introduced as an ornamental plant, but has also been used for erosion control. Within the Park it occurs predominantly along roadsides or within disturbed areas. It has also been documented in the oasis section of Borrego Palm Canyon since the early 1970s and is known to occur hundreds of feet up the steep rocky slopes of both Indian Head Mountain and the north wall of Flat Cat Canyon, miles from any road or stream.

African Fountain Grass is a perennial bunch grass with an attractive, plume-like inflorescence bearing many bristly seeds, which are easily dispersed by wind. It blooms from July through October, and is widely cultivated on residential and commercial properties in the Borrego Valley.

**Athel, Salt Cedar, Tamarisk** (*Tamarix aphylla* and *T. ramosissima*)

Tamarisk is the most troublesome exotic plant in ABDSP. *Tamarix ramosissima* (Salt Cedar or Tamarisk) is a highly aggressive and rapidly spreading riparian shrub. It is part of a five-species *Tamarix* complex that is currently hybridizing and spreading across the United States. It is extremely well adapted to saturated, saline soils.



Tamarisk effectively out-competes native species through rapid and dense growth, high water usage (and water table depletion), extreme resistance to drought, high fecundity, and also through the production of salts that inhibit the germination and growth of native species. As a streamside population of salt-cedar grows, it spreads from the edges towards

the middle, narrowing the stream channel and increasing the potential for flood damage. Tamarisk is not known to benefit wildlife to any significant extent because it offers little food, shelter, or desirable nesting sites.

*Tamarix ramosissima* has been found in nearly every low-elevation location that supports riparian habitat or that periodically holds significant flood runoff. It is especially prevalent in Coyote Canyon and Sentenac Ciénaga, and throughout the entire Carrizo Creek watershed. This species is a major threat to many of the sensitive species found in ABDSP and its proliferation may have serious consequences for the biodiversity of the region.

The less invasive *Tamarix aphylla* (Athel) is often planted as an ornamental, shade, or windbreak species because it develops quickly into a substantial tree. The Athel Tree is present at the Agua Caliente Store (land leased from ABDSP), in Clark Valley, along South Carrizo Creek Road, at the Tamarisk Grove Campground, Vern Whitaker Horse Camp, and bordering many agricultural fields of Borrego Springs.

**Exotic Animals**

Nearly fifteen exotic animal species are common within ABDSP and ten of those have a high priority for management action due to their potential to alter natural habitats or to out-compete, prey upon, or otherwise negatively affect native species. These high priority exotic animal species are discussed below.

**Crayfish** (*Procambarus clarkii*)

Repeated surveys have documented Crayfish in Sentenac Canyon. This exotic species is an aggressive competitor and is known to affect native invertebrate, fish,



and amphibian populations. Herbst et al. (1995) noted that the crayfish “appeared to be strongly inhibiting the abundances (and even presence) of native aquatic plants and animals in the canyon, particularly algae and insects that would be associated with this habitat.”

**Bullfrog** (*Rana catesbeiana*)

Bullfrogs are found in perennial aquatic habitats and have been documented in the Lucky 5 Ranch region as well as in Culp Valley. This is an extremely aggressive predator and its occurrence and proliferation throughout the aquatic habitats of the Park are a major concern.

**Virginia Opossum** (*Didelphis virginiana*)

Virginia Opossum may be found in riparian areas, wetlands, montane and developed portions of ABDSP. This species may affect native mammals and birds by preying upon their young.

**Brown-headed Cowbird** (*Molothrus ater*)

Brown-headed Cowbirds are known to use cropland, grassland, urban, and riparian areas. This species is found throughout California. In ABDSP, the Brown-headed Cowbird is common in areas such as Agua Caliente, Borrego Palm Canyon, Bow Willow, Canebrake, Carrizo Marsh, Clark Dry Lake, Culp Valley, Indian Valley, Lower Willows, Mesquite Bosques, Mountain Palm Springs, Sentenac Canyon, Yaqui Well, and Borrego Valley. Although many disperse throughout the Park, large numbers tend to concentrate through Coyote and Sentenac Canyons.

As a brood parasite, the Brown-headed Cowbird lowers the reproductive success of many riparian-dependent passerine species. This is of particular concern for populations of Least Bell’s Vireo in ABDSP. A Cowbird-trapping program is currently being conducted annually from mid-March through June, with 200 to 400 cowbirds removed each year.

**European Starling** (*Sturnus vulgaris*)

European Starlings were brought from Europe in the late 19<sup>th</sup> century. They are aggressive competitors known to mob and evict native birds from cavity nests. A trapping and removal program was initiated in 2000.

**Game Birds**

Since transplants by CDFG in 1994, the wild Turkey has established a widespread range throughout the region. From 1 to 12 individuals have been recorded on various locations including Vallecito Ciénaga, Scissors Crossing, Borrego Valley, Grapevine Canyon, Ranchita, and Tamarisk Grove. To date there is no documented nesting or year-round occupation in the desert portions of ABDSP. It is expected that they have become resident in suitable habitat throughout the Peninsular

Ranges. Chuckar and Pheasant are also released by CDFG on adjoining property. Although successful populations of these species are not currently known from ABDSP, potential establishment and the resulting ecosystem affects are a concern for the natural resources of ABDSP.

### **Domestic Livestock and Feral Animals**

Throughout California, feral Horses occur mostly in Modoc, Lassen, Mono, and Inyo counties with isolated populations spread throughout the state. It is estimated that somewhere between 20 and 30 feral Horses exist in the Coyote Canyon watershed. This species is known to use grasslands, meadows, pastures, pinyon-juniper, desert scrub, and riparian areas. They are typically found in canyons with adequate water such as Horse Canyon, White Wash, Nance Canyon, Tule Canyon, Parks Canyon, Alder Canyon, Upper Willows, Middle Willows, Lower Willows, Collins Valley, and occasionally from Jackass Flat to North Table Mountain. This species spends much of its time in riparian areas, adjacent alluvial fans, and desert scrub. Their impact on these habitats is quite noticeable and the extent to which they negatively affect soil integrity, plant species, water quality, aquatic organisms, as well as paleontological, archaeological, and historic sites is thought to be significant.

Feral Cattle numbered into the 100s in the late 1980s. Although Park staff successfully completed an extensive cattle removal program, escaped cattle still pose a problem. Reinvansion of the Park by escaped or feral cattle, or trespass grazing can be expected to reoccur periodically from nearby ranching operations into such locations as Upper San Felipe Valley, Palm Canyon, Upper Hellhole Canyon, Upper Coyote Canyon, and Inner Pasture. Feral and trespassing Cattle have the potential to cause extensive damage to natural and cultural resources of ABDSP.



Feral Goats have been documented in association with Bighorn Sheep within the Park. Evidence has pointed to domestic Sheep as the cause of pasturella pneumonia die-offs of Bighorn Sheep. Domestic livestock and feral animals may also function as vectors for other diseases such as bluetongue virus (USFWS 2000b). Therefore, the presence of domestic livestock and feral animals within the Park pose a potential serious threat to the endangered Bighorn Sheep population. Domestic livestock and feral animals may also reduce the availability of water and forage for native species.

### 2.2.3 CULTURAL RESOURCES

#### 2.2.3.1 Prehistoric and Ethnographic Overview

ABDSP has an impressive inventory of historic resources. Scattered throughout its rocky canyons and arroyos, down to its sandy washes and dry lake beds are historic sites that document the flow of history.

##### Early Cultural Periods

The land now encompassed by ABDSP has a long and multifaceted history of human habitation and utilization. The prehistory of ABDSP has been divided into four periods: the San Dieguito Period, the Early Archaic Period, the Late Archaic Period, and the Late Prehistoric Period. Some researchers have also advocated a fifth period; a Late Pleistocene/Early Holocene cultural pattern (called “Malpais”) that predates the San Dieguito Period.

***San Dieguito Period:*** Most researchers recognize San Dieguito or Paleoindian Period, dating to the early Holocene, as the earliest cultural period in the Colorado Desert (circa 10,000 to 8,000 years before present [B.P.]). Most San Dieguito sites are found on mesas and ridges and generally lack midden. Common San Dieguito artifacts have been defined as a wide range of scrapers; leaf-shaped knives and dart points, with an occasional stemmed or notched specimen; flaked-stone crescents; relatively few hammerstones; and “crude” chopping tools. The artifacts identified as possible San Dieguito assemblages show appreciable desert varnish.

Some cleared-circle sites, situated upon desert pavement surfaces in ABDSP, may be San Dieguito in age, though most of them likely date to the subsequent Archaic Period. The circles vary in size, may have multiple “rooms,” and may be rock-outlined.

***Early Archaic Period:*** Few sites and sparse remains define the next cultural period in the Colorado Desert, termed the Early Archaic. Cleared circles on mesa tops with desert pavement are characteristic of this time period, as well as simple flake tools, no ceramics, and a lack of groundstone tools. Populations were apparently low in Early Archaic times and movements within the region were frequent during the year. This period ranges in age from circa 8,000 to 4,000 years B.P.

***Late Archaic Period:*** People with a more diversified economic base characterized the Late Archaic, ranging in age from circa 4,000 to 1,500 years B.P. Late Archaic people efficiently used seasonally available plant foods, as evidenced by the presence of groundstone tools and cache pits in sites of this period, while evidence of hunting continued. These prehistoric people were highly mobile hunters and

gatherers with a low population density. Indian Hill Rockshelter in the southern end of ABDSP yielded one of the few Late Archaic cultural components in the Colorado Desert. Archaic sites have dart points, such as Elko series, groundstone implements, and lack ceramics. Geological forces, such as sheet wash and alluvial deposition, may affect the archaeological visibility of Archaic sites in the Park or they may be hidden by the dense cultural remains of later people.

***The Late Prehistoric Period:*** The Late Prehistoric Period in the Colorado Desert begins around A.D. 500 and likely originated out of the Archaic Period. Artifact assemblages characteristic of the Late Prehistoric include ceramics (esp., Brownware and Buff wares); clay pipes; small triangular-shaped, side-notched and serrated projectile points; increased use of obsidian; groundstone tools; bedrock grinding and pounding features; soapstone implements; shell beads; cremations; rock art; and earthen art.

### *Ethnographic Overview*

ABDSP is within the traditional territories of three Native American groups, the Kumeyaay, the Cahuilla, and the Cupeño. The Kumeyaay had occupied significant portions of the central section of the park and all of the southern section of the park. The Cahuilla used the northern section of the park, i.e., north of Borrego Springs. Traditional Cupeño territory is peripheral to northwestern areas of the park, such as, the middle fork of Borrego Palm Canyon; portions of their territory may have overlapped Kumeyaay and Cahuilla lands in prehistory. (For a more complete discussion of these Native American groups please see Appendix 5.1)

***Kumeyaay:*** The Kumeyaay have been identified by a variety of names, including Diegueño, Tipai, Ipai, and Kamia.

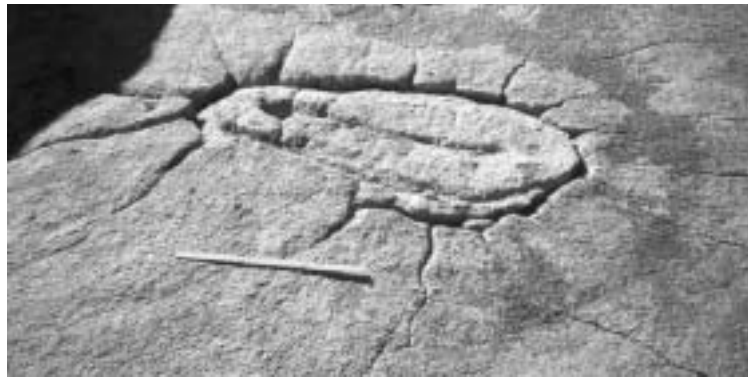
Kumeyaay traditional territory includes a significant portion of present-day San Diego County up to Aqua Hedionda and inland along San Felipe Creek (just south of Borrego Springs). The territory is bounded to the east by the Sand Hills in Imperial County and included the southern end of the Salton Basin and all of the Chocolate Mountains. Kumeyaay territory extended southward to Todos Santos Bay, Laguna Salada, and along the New River in northern Baja California. That places the central and southern portions of ABDSP within traditional Kumeyaay territory. The Luiseño, Cupeño, Cahuilla, Quechan, Cocopa, and Paipai bordered Kumeyaay territory.

Estimates of Kumeyaay population prior to European contact are difficult to obtain. The most recent research, based upon counts of known villages and other data, calculated an estimate of 17,000 Kumeyaay. Diseases introduced by the Spanish and later the Mexicans resulted in profound decreases in Kumeyaay populations.

The language of the Kumeyaay people, called Diegueño, belongs to the Yuman linguistic family. Yuman languages are a division of the Hokan Stock. The Hokan Stock represents the oldest language group in California. Indian people who bordered the Kumeyaay in northern Baja California and those living to the east in present-day Arizona spoke Yuman family languages also.

*RELIGION:* The Kumeyaay had ritual specialists or shaman (*kwasiyai* or *kuseyaay*) who served a critical role in the group. The Kumeyaay had curing and rattlesnake shamans. The shaman was also responsible for the production of most rock art. Rock art was sacred, played a role in rituals, and in many cases represented a visualization of mythical or other higher beings observed in dreams.

Religious rituals played a significant role in the everyday lives of southern California Indians. Some of the more important rituals performed by the Kumeyaay and other Californian groups were the annual mourning ceremony, eagle ceremony, rites of passage (e.g., male and female initiation), rituals designed to control the environment, and ceremonies to honor the deceased. The Kumeyaay, as well as the Luiseño and Cahuilla, also had religious plant food specialists who controlled knowledge concerning the location and development of plant-food resources.



*SETTLEMENT PATTERNS:* The Kumeyaay were organized into territorial bands. The band territory consisted of a section of a major drainage and its tributaries. Each band had a central primary village and a number of outlying camps located at small water sources, springs, or at the mouths of small watercourses. Kumeyaay bands living in the Laguna Mountains migrated to the desert areas in and next to ABDSP during the winter and stayed until early spring.

The Kumeyaay had a well-developed network of trails throughout their lands. Trails used by prehistoric people followed canyons on the mountainside, such as, Cottonwood Canyon and Storm Canyon, to reach the desert foothills and floor. For example, aboriginal people wintered in Mason Valley, Hapaha Flat, Harper Flat, Pinyon Mountain Valley, Canebrake Canyon, and other areas within and adjoining the park.

Kumeyaay houses (*awa*) varied in construction depending upon season, function, availability of raw materials, or other factors. Mountain houses were built circular

in form. The support poles would be made from Pine or Juniper. The height averaged five feet (1.5 m), and they were large enough for a family to sleep inside. Winter houses, used in the desert, were similar in design. Desert Willow was used in the framing of desert houses, while thatching material included Arrowweed, pine boughs, or marsh grasses. Simple lean-to shelters were also used in desert camps, usually by a person living alone, or for special purposes. Kumeyaay also constructed specialized structures such as brush dance circles used in various ceremonies.

**FOOD:** Plant foods represented the most important component of prehistoric diet for hunter-gatherer people such as the Kumeyaay, and availability of important plant foods greatly influenced movements of groups. Within Kumeyaay territory, various plants with potential food uses (e.g., Cactus, Chia, Grass, Ocotillo, and Yucca), ripened earliest on the lower elevations of the desert floor. The harvest of Agave (*Agave deserti*) occurred primarily in April or May, but could begin as early as February. Significantly, Agave plants (*'emally*) are abundant in the desert foothills and desert floor, and as a food product are reliable, nutritious, and can be stored for long periods of time. Agave also provided other useful products such as fiber.



Aboriginal people returned to the desert in mid-summer to harvest Mesquite (*tam yea*), another important food. Mesquite plants are abundant and each plant produces a large number of pods. Mesquite pods are procured easily and can be stored for long periods of time.

Kumeyaay people who resided in the Imperial Valley and Salton

Basin practiced agriculture in the late spring when the Colorado River overflowed its banks. They grew Cowpeas, Gourds, Maize, Pumpkins, Teparies, and Watermelons; however, gathering of wild plant foods remained an important basis for sustenance.

The Kumeyaay of the desert hunted rodents, Chuckwalla, Jackrabbits, Cottontail, Deer, Bighorn Sheep, and other animals. Hunting equipment included bows made from Huckleberry, Mesquite, or Willow; arrows made from Arrowweed; a curved throwing stick; and traps and snares.

**UTENSILS:** Ceramic implements played a key role in the everyday life of aboriginal Kumeyaay people. A variety of vessel forms are known to have been made by the

Kumeyaay, including large storage ollas (*pahatc*), water ollas, cooking pots and bowls, pipes (*mokwin*), and rattles. Among the Kumeyaay, all people could use any clay source for pottery making, though, individual potters obtained raw material from specific spots within the source.

The Kumeyaay manufactured both coiled and twined baskets for a variety of uses. Basket types included seed beaters, hoppers for mortar holes, winnowing baskets, leaching baskets, granaries, basketry caps, and nets. Principal raw materials used in Kumeyaay basket making are *Muhlenbergia rigens*, *Rhus trilobata*, *Juncus textilis*, and the needles of *Pinus jeffreyi* or *Pinus ponderosa*.

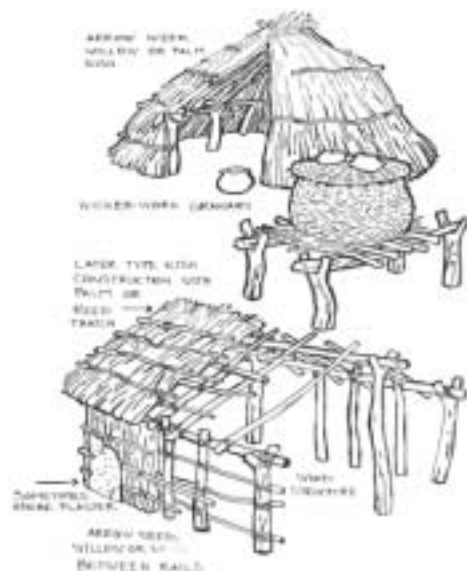
**Cahuilla:** The northern end of ABDSP is within the traditional Cahuilla territory, including Borrego Palm Canyon, Coyote Canyon, Clark Valley, the Santa Rosa Mountains, Jackass Flat, Rockhouse Canyon, Horse Canyon, and other places. Some northerly areas of the park, such as the San Felipe Creek drainage, Culp Valley, Pinyon Ridge, the Borrego Badlands, and Borrego Valley, may have formed a so-called “transitional zone” between the Cahuilla and the Kumeyaay. The two groups would have used the latter areas jointly, or, as convenient for subsistence or ceremonial needs. Lands of ABDSP fall within Mountain Cahuilla territory.

The population estimate for the aboriginal Cahuilla stands at approximately 6,000 people, based upon many lines of evidence. Introduced diseases, use of lands for livestock grazing, and conflicts with the Spanish almost immediately affected the contact-period population of California Indians, including the Cahuilla.

The Cahuilla language, called *ivi at* or *ivilu at*, is part of the Takic family of the Uto-Aztecan stock. There are three dialects of the Cahuilla language, Desert, Mountain, and Pass. The dialect spoken by the Mountain Cahuilla people reportedly differs slightly from that of the Desert and Pass Cahuilla. The Cahuilla, as a whole, speak the same language and recognize a shared cultural heritage.

**SETTLEMENT PATTERNS:** The basic Mountain Cahuilla social and political unit was the localized paternal clan. The clans then subdivided into lineages. Clans would have been comprised of three to ten lineages, each claiming a common genitor, and one lineage was recognized as the founding line.

Lineages would own a village site and certain resource areas, though, most of the land recognized as clan territory was open to all





Cahuilla. The leader of the lineage was the *net*, a position normally inherited from father to eldest son. The *net* had numerous responsibilities and societal functions including the correct maintenance of rituals, care of the ceremonial bundle, maintenance of the ceremonial house, and determination of where and when to conduct hunting or food-gathering activities.

Most desert region houses were dome-shaped but varied in size. Some houses measured up to 15 to 20 feet (4.5 to 6 m) in length and width, while others were mere brush shelters. The roofs were thatched with available material, such as Palm fronds, Arrowweed, Willow, Tule, or other plant materials. Houses would be built adjacent and connected by thatched arbors or ramadas that served as shade and windbreaks. A hole would be left in the roof to allow smoke to escape from the hearth. Francisco Patencio, a noted Cahuilla elder, remembered that aboriginal Cahuilla people lived outdoors during most of the time in summer. Shelter then consisted of simple ramadas constructed with poles and covered in palm fronds or brush. Similar ramadas would be used for short-term camping on food-gathering trips.

Cahuilla villages also had a sweathouse (used by men), granaries (used for storage of important foods), and water wells (structures of varying dimensions for obtaining water). The sweathouse would measure 10 to 15 feet (3 to 4.5 m) in diameter, 4 to 5 feet (1.2 to 1.5 m) high, and was covered with brush and dirt.

The locations of Mountain Cahuilla clans prior to European contact had been subject to changes created by a variety of causes. Influences from the Spanish and the Mexicans in the 18th and 19th centuries were profound. A smallpox epidemic around 1875 killed numerous Mountain Cahuilla of the *Wiwaiistam* clan in Coyote Canyon. This epidemic caused the people to burn “all the houses in several villages” and move to another village away from Coyote Canyon (*Patcawal* at San Ignacio).



**RELIGION:** The largest building in a village would be the ceremonial house. It was a dome-shaped building and could be up to 50 feet (15 m) in diameter. This building was similar in construction to that of a normal residence. The ceremonial house was used for meetings, rituals, dancing, as a sanctuary for the ceremonial bundle (*maiswat*), and as a residence for the *net*. The Mountain Cahuilla called their

ceremonial dance house *kicamnawut* or *wamkic*. A dance house existed at *Wiliya*, a village formerly located within the Middle Willows area of ABDSP, and was used for rituals.

Oral literature, in particular songs, served as the repository of Cahuilla laws and principles of appropriate behavior. Elders played a critical role as the ones who taught the established societal values and skills important in everyday life, to the young. Music and songs were a critical part of ceremonies and other aspects of everyday life.

Rituals played an important role in the everyday life of the Cahuilla. They were pervasive in all societal institutions. Some of the important rituals included the *nukil*, an annual week-long ceremony honoring deceased lineage members, the eagle ritual that celebrated the longevity of the lineage; initiation rituals for both boys (*manet*) and girls (*emeuluniwe*); first-fruit rituals, a three-day ceremony to celebrate the beginning of food-gathering season; curing rituals; rituals to ensure hunting success; and other ceremonies.



**FOOD:** Each Cahuilla lineage located their permanent village close to a wide range of natural resources, usually within the center of the richest food-gathering area. At no time during the year did the entire population of a village move to another location, though, a large number of people might move to perform seasonal gathering activities.

In spring, Agave, Cacti, Catclaw, Grasses, Ocotillo, various greens, Yucca, and other plant resources became available for gathering. A concentrated area of *Agave deserti* within Lower Willows (Coyote Canyon) was the favored gathering location for Cahuilla lineages that resided in ABDSP. Gathering of various plants continued into the early summer.

Mesquite (*Prosopis glandulosa*) and Screwbean (*Prosopis pubescens*) pods became available by July. The gathering of Mesquite and Screwbean pods was attended by a large portion of the village and continued for several weeks. Acorns were the last important food resource gathered in a year, usually in October and November. An acorn harvest could last from three to four weeks, during which time the Cahuilla camped within the Oak groves. Most people of a village moved to the groves for the harvest and specific lineages would use the same gathering camps each year. Trails

typically existed to connect the villages to the Oak groves. San Ysidro Mountain was one location used by the Cahuilla of Coyote Canyon to gather acorns.

The end of the yearly seasonal food-gathering period came in November. Hunting and the use of stored foods provided the main sustenance in the winter among the aboriginal Cahuilla. Reciprocity was a pervasive societal value, and food was redistributed between Cahuilla lineages as part of the ritual activity.

Hunting by men of Rabbits and other game was another important economic activity that took place during the Mesquite harvest. The Cahuilla used bows and arrows, throwing sticks, nets, and traps in hunting game. The bow was typically manufactured from Willow or Mesquite wood. The throwing stick was reportedly effective in killing Rabbits and Hares. Eighteenth century accounts by Spanish observers provide testimony to the skills of Native Americans in using the throwing stick to hunt small game.

*UTENSILS:* Baskets played a key role in the aboriginal economic tasks and the rituals of the Cahuilla. The Cahuilla made a variety of twined and coiled basketry products of renowned quality including carrying nets, seed beaters, flat plates, bowls, carrying and storage baskets, caps, and hoppers for use with the mortar and pestle. Various species of Juncus, as well as Sumac, Deer Grass, Mohave Yucca, and Agave were employed in producing basketry and fiber.

The Cahuilla employed the paddle-and-anvil technique and red-burning residual clays to manufacture ceramic items. The Cahuilla made storage ollas, water ollas, small-mouthed jars, cooking pots, open bowls, dishes, and pipes.

### *Archaeological Sites*

A total of 4,322 historical resources, either archaeological sites, isolates, or other historical properties, have been documented within ABDSP. It has been estimated that approximately eight percent of the park has been surveyed for historical



resources. Detailed descriptions and locational information for the recorded sites and isolates are found in California State Park files and at the appropriate Historical Resources Information Centers.

Early archaeological investigations within ABDSP began in the 1920s. Over the years, a significant number of archaeological sites have been recorded. Recent studies have

documented an extraordinary diversity of sites in such areas of the park as Blair Valley, Carrizo Canyon, Coyote Canyon, Culp Valley, Earthquake Valley, Harper Flat, Indian Hill, Sentenac Canyon, the Vallecito Mountains, and other locations. Archaeological investigations by State Park staff and park volunteers are ongoing today throughout ABDSP.

Native American sites within ABDSP show extraordinary diversity of content and can be found throughout the park. An estimated 693 of the total prehistoric sites within the park show evidence of occupation, either as long-term dwelling locations with appreciable midden deposits and numerous cultural remains or short-term camp locations showing low-density artifact distributions. Sites showing only roasting pit or earth oven features are a common element of the cultural environment, with an estimated 1,005 present. Sites showing only bedrock milling, grinding, or pounding features, number 940 and occur in all areas of the park. Aboriginal rock art, a culturally significant and highly sensitive site type, occurs at 108 sites.

Archaeological sites identified as being within traditional Kumeyaay territory show approximately twice as many rock art elements as those located in traditional Cahuilla territory. Cleared circle features, hypothesized to represent house remains, are a curious cultural component of Colorado Desert archaeology and can be found at 235 sites within the park. Evidence of aboriginal human remains, in particular, cremations, has been documented at 52 archaeological sites within the park. Other prehistoric site types found within ABDSP include tool-stone quarries and prospecting areas, trails, rock features, food-gathering areas, and isolated finds. The presence of rock art is a good indicator of areas held sacred by the aboriginal inhabitants of the park. Kumeyaay and Cahuilla people have identified traditional cultural places, areas of the park held in esteem by living Native American communities, within the park.

#### **2.2.3.2    *Historical Summary***

ABDSP has been witness to the flow and ebb of historic events dating back hundreds of years. Some of these events are associated with national and statewide historic themes, such as exploration, settlement, and military operations from the 18th through the 20th century. Associated with these themes are a number of explorers, soldiers, settlers, and prospectors who dealt with the desert in their own way. While some were “merely passing through,” others sought to eke an existence from the desert’s natural resources.

***Spanish Colonials:*** Some of those individuals who have left their mark while passing through what is now park land were Spanish Colonials seeking to establish overland trails connecting Old Mexico with Alta California’s nascent coastal

settlements. Lieutenant Colonel Juan Bautista de Anza, who is immortalized in the Park's name, led two expeditions through the area. The first was an exploratory mission in 1774-75. During the second trip he retraced his steps, leading a large group of settlers to found San Francisco the following year.

Although the Spanish did not settle the area, they did leave a legacy of lyrical place names. For example, they named Carrizo Creek, Tierra Blanca, Piedras Grandes, and Dos Cabezas after natural and geological features. They also named sites after Roman Catholic saints like San Felipe, Santa Rosa, and San Ysidro. The second half of the Park's hyphenated name, "Borrego," is Spanish for "yearling sheep."

**Anglo-Americans:** While officially a part of Spanish and later Mexican California, the desert was familiar territory to an increasing number of Anglo-Americans from 1829 to the outbreak of the war with Mexico in 1846. American soldiers used the main road through the desert as one of their major "invasion" routes into California. The hack marks made by members of the famous Mormon Battalion can still be seen in Box Canyon. Participating in the longest march in U.S. military history, they used axes and crowbars to widen a passage for their wagons. After the war, hundreds of emigrants, Mexicans as well as Anglo-Americans, streamed across the desert on their way to northern California gold fields.

The incessant human traffic had a detrimental effect on the area's local Indian population. Besides having their water sources polluted and native plants destroyed, the Indians were constantly harassed. Things came to a head in 1850-51 during the so-called "Garra Rebellion." Led by Cupeño, Antonio Garra, bands of Indians attacked a number of Anglo-American settlements, including nearby Warner's Ranch, which they destroyed. As a result of the uprising's eventual suppression, the local Indians were forced to abandon Los Coyotes and other villages in Coyote Canyon.

With the end of the last Indian uprising in southern California, settlers were once again using the Southern Emigrant Trail through what is now ABDSP. The initiation of the first overland mail service between San Diego and the East Coast was also during this time. In 1857, the "Jackass Mail" followed a segment of an older Spanish trail from the desert floor up through Oriflamme Canyon to the Cuyamaca Mountains. The Jackass Mail was superseded in national importance after the inauguration of the Butterfield Overland Express in 1858. Legendary in the annals of Western history, the 2,800-mile Southern Overland Mail Line ran overland mail and passenger from Tipton, Missouri to San Francisco and Sacramento, California. Unfortunately for San Diegans, it bypassed their town completely. However, the Jackass Mail continued to provide service off and on to San Diego until 1861. The stage coach lines' legacy in ABDSP can be seen in four of the line's

six San Diego stage station sites: Carrizo Springs, Palm Spring, Vallecito (S.D. County owned and operated), and San Felipe near Scissors Crossing.

Although abandoned by the stage lines during the outbreak of the Civil War, the old network of trails continued to serve an important purpose. Federal troops from San Diego and Fort Yuma, Arizona Territory still patrolled it, escorted supply wagons, and guarded the gateway into southern California from Rebel forces. After the war, returning veterans and hundreds of displaced confederates traveled through what is now ABDSP to start a new life in California. Several of the latter settled in the nearby Julian area after the discovery of gold in 1870. Interest in establishing a direct road between the gold mines and the east allegedly resulted in the naming of Borrego Springs, and subsequently the valley, by the survey party. Apparently unfamiliar with the Spanish language, they erroneously spelled it “Borego,” which remained on maps until the 1950s.

***Desert Settlement:*** Both during and after the Julian gold rush, a number of enterprising individuals chose to make the desert their home. The names of many of these early settlers dot the Park’s map: Sentenac, McCain, Harper, Benson, Butler, and Clark among the most notable. What attracted these pioneer ranchers to this region were lush meadows, ample water, and the mild winter climate. After a particularly wet winter, the desert offered a bounty of springtime flowers and native grasses. Cattlemen drove their herds down from the nearby coastal mountains around November, returning before the summer’s heat dried up the forage. Among the earliest to do so were the Helm brothers, who ran cattle from the Warner Ranch/Montezuma Valley area in the late 1860s and early 1870s. By the mid-1880s it was common practice to winter cattle in the desert. It has been estimated that as many as four to five thousand head of cattle could be found grazing in desert “cow camps” in a good year. No doubt the cattlemen’s historic use of the Colorado Desert to free range their cattle for over a hundred years has had an effect on native desert ecology.



In conjunction with cattle raising, most of the desert’s early settlers were involved in some form of mining. As the neighboring Julian gold fields eventually played out, prospectors gravitated eastward toward the nearby desert mountains and foothills. Borrego Springs became the nexus for gold prospecting in the area during the late 1880s and early 1900s. While miners dug primarily for gold well into the early 20th century, others searched for and extracted calcite, tungsten, strontium, and later, uranium.

A colorful, but often overlooked phase of this region's™ extractive industries includes the futile search for petroleum and natural gas. During the first quarter of the 20th century, a growing demand for oil and gas products created a wave of speculative petroleum prospecting in California. Prospectors were sure that the sedimentary deposits located in the area were sure signs of potential oil sources. As many as seven oil companies drilled for oil and gas, but none of them produced any appreciable results. Artifacts from this period litter the landscape, including trash deposits and abandoned mine sites.

The early 20th century saw an increase in attempts to settle the Colorado Desert area. This can be seen as the result of a land boom in Imperial Valley, due in part by the arrival of irrigation water from the Colorado River in 1901. With irrigation came a wave of agricultural/ranching activities, which resulted in speculative town building. The excitement of reclaiming the desert naturally spilled over into Borrego Valley. Many homesteads, though, were soon abandoned; the heat, winds, and drifting sand dunes driving away all but the hardiest settlers. One observer noted: "It is mainly the jackrabbits that profit by the crops planted by the pioneers...."

The next and perhaps the most important phase of the Park's™ history began after World War I. Returning veterans took advantage of special homestead laws that made it easier for them to file homesteads. This, plus the completion of the original Julian-Kane Springs Road in 1925, brought additional settlers into the region, which in turn stimulated speculative real estate sales and promotion. Adding to the draw was the successful drilling of a deep-water well on the Ensign Ranch [outside the park] in 1926, which produced 1,000 gallons per minute. This was proof enough to the land boomers that there was an ample supply of water in the aquifer beneath the valley's floor. Soon a number of ranches were established in the valley, growing alfalfa and winter vegetables.

During the 1920s, the combination of a growing population, plus improved roads and highways, along with more reliable automobiles, brought an increase in recreational automobile travel throughout southern California. This was especially true in the Colorado Desert. Besides driving over the old Southern Emigrant Road, auto enthusiasts could also visit the desert's southern regions in the In-Ko-Pah and Jacumba Mountains by driving along an improved highway that was basically an old stage road from San Diego to Yuma through the Mountain Springs Pass. Incorporated into the national Lee Highway system in 1926, it introduced auto-tourists to what is now the Park's southern entrance.

No other route through the desert offered a more spectacular view of the Colorado Desert's southern region than the San Diego and Arizona Railway. Completed on November 15, 1919, it traveled from San Diego, along and crossing the California-



Mexico International Border to Jacumba, where it eventually entered what is now ABDSP. Its torturous route passed through several tunnels blasted out of solid granite and across a number of wooden trestles spanning deep gorges. Advertised nationally, the route offered passenger service up until the 1950s and introduced hundreds of passengers to the desert's rugged beauty.

***Creation of a "State Park":*** It was during the prosperous "Roaring Twenties" that the idea for establishing ABDSP was born. A successful 1928 bond drive, plus advocacy by state and local civic leaders and environmentalists, persuaded the State Park Commission to create the Borrego Palms Desert State Park in 1933. Originally consisting of 83,840 acres, the park was expanded to 448,840 acres in 1936. In December 1941, the State Park Commission further expanded and dedicated the Anza Desert State Park to the memory of Colonel de Anza and all of the other pioneers and settlers. During the ceremonies, California Department of Beaches and Parks representatives "pledged to preserve the park in its natural state so future generations also might enjoy its intrinsic qualities." However, the State didn't receive full patent to the federal lands until May 1948. Over the next few years, land swaps and exchanges with private landholders would eventually result in the Park's present acreage.

***Civilian Conservation Corps:*** During the twenty-odd years between the Park's inception and final acquisition, two major historic events affected the Park's development. The first was the Great Depression and the second was the United State's entry into World War II. The former saw the coming of the Civilian Conservation Corps (CCC) to the Park. The "Triple Cs" would work on a number of key federally funded public works construction and resource conservation projects throughout the Park from 1933 to 1942. Among the CCC's earliest projects was the grading and improvement of the automobile road through Sentenac Canyon and Yaqui Pass in 1932. CCC crews constructed the historic core of the Borrego-Palm Canyon Campground. Included among the camp improvements were tables, benches, cupboards, stoves, ramadas, comfort stations, parking facilities, and water systems. They also constructed a Custodian's Residence/Park Headquarters building and amphitheater near the campground. Still standing, the residence's native stone and rustic wood construction are signature design elements of CCC-built park buildings constructed throughout California's state parks.



Custodian's Lodge,  
Borrego-Palm Canyon Campground, ca. 1938

***Military and Scientific Activities:*** With the outbreak of World War II, the United States military turned sections of the park into a vast training center. The military's

main use of parkland was for artillery and aerial gunnery, and rocket and bombing training. Reminders of these activities can be found at Clark Dry Lake in the form of abandoned emergency dirt landing strips and the ruins of “Rake Stations” — reinforced concrete observation posts that protected observers inside from bomb fragments and stray bullets. The war’s legacy can also be seen in the Carrizo Badlands. Located between Fish Creek and Coyote Mountains, the more than 27,000-acre “Carrizo Impact Area” is still closed to the public due to the presence of unexploded ordinance ranging from bombs to air-to-ground rocket warheads.



Rake Station Ruins,  
Clark Dry Lake

Other military-related activities conducted within the Park included the testing of ground-based rockets north of Borrego Mountain. Although these experiments were unsuccessful, the attempts contributed to the United States advancement of rocketry, which, besides the atom bomb, was the most significant weapon development during World War II.

Another important wartime activity was the mining of calcite in the park. Used in the manufacture of artillery optics, sources of calcite were of strategic importance during the war. The calcite mine near the south fork of Palm Canyon contained one of the most important mining operations in the Western Hemisphere until the advent of synthetic calcite crystals.

After the war, scientists continued to use the park to conduct experiments. Starting in 1958, astronomers erected and enlarged a radio observatory facility at Clark Dry Lake. The facility’s purpose was to observe the universe by listening to radio emissions emanating from quasars, pulsars, novae, and supernovae, and other celestial phenomena. Linked together by computers, the individual radio antennae arranged around a central lab building became one of the most powerful and versatile low frequency radio telescopes in the world. In 1986, with its funding gone, the radio observatory was abandoned. Nothing remains today of this important historic facility once associated with post war advances in radio astronomy.

**Tourism:** To facilitate the movement of troops and equipment during the war, the U.S. military improved several roads into and through the park. All of which resulted in improved automobile access after the war. However, these were inadequate due to demands made by increased agricultural, tourist, and real estate activities. From as early as the 1930s, local real estate developers and businessmen sought to turn the Borrego Valley into a desert winter resort similar to Palm Springs in Riverside County, with the newly laid out town of Borrego Springs as its epicenter. After the war, air conditioning, cheap gas, and the proliferation of

personal automobiles sparked an increase in vacationing tourists, which also necessitated improved and additional roads. Improved access to the valley stimulated interest in developing Borrego Springs as the gateway to one of the largest State Parks in the nation. Besides automobile traffic, improved roads brought regularly scheduled bus service from San Diego. In addition, a county airport was built in 1949, with hope of catering to the vacationing Hollywood crowd.

Plans to develop Borrego Springs into a resort community to rival Palm Springs had an inexorable effect on the Park. The damming of Coyote Canyon was called for, so the resulting reservoir could serve as a permanent source of water as well as a “sportsman’s paradise.” The proliferation of relatively inexpensive Jeeps and other war-surplus four-wheel drive vehicles had also created an entirely new recreational activity in the Park and surrounding areas. Increased access to once remote areas of the Park brought a spate of looting of ancient Indian artifacts, as well as geological and plants specimens. Many of the plants removed from the Park reportedly went into the landscaping of “newly built houses in Borrego Valley.”

As a result of post war increases in visitation, park facilities were improved and expanded. For example, in 1952 a new campground, residence, and workshop were built at Tamarisk Grove on the site of a former County Honor Farm. A decision was also made to administer the Park as two sections: Borrego State Park headquarters at Borrego Palm Canyon, and the new Tamarisk Grove administration center and campground. This remained in effect until 1957 when the two parks were combined into the present ABDSP. Under the new administration, park staff was nearly doubled, with sixteen rangers patrolling eight 60,000-acre districts: Sheep Canyon, Palo Verde, Tamarisk Grove, Blair Valley, Culp Valley, Fish Creek and two at Bow Willow. Four new ranger outposts and radio-equipped four-wheel drive vehicles augmented the rangers, who were now trained in desert tracking, and search and rescue methods. Assisting park personnel were interested groups like the Desert Protective Council, the Sierra Club, and the Anza-Borrego Natural History Association, which lobbied to safeguard the entire desert, including the park, for future generations to enjoy.

### **Principal Historic Period Themes**

The following is a list of themes that are meant to organize historic time into coherent patterns that have influenced the Park’s development during one or more periods of its history. They can be used to place and categorize the Park’s recorded and potentially eligible historic resources into their applicable historic context. For example, the remains of the Sentenac homestead could be placed within the context of Prospectors, Homesteaders, Ranchers, and Real Estate Developers, 1872–1970. Surviving CCC-era campground improvements, on the other hand, can be categorized under the Creation and Early Administration of ABDSP theme, 1932–

1942. (See “Park-wide Goals and Guidelines, Interpretation,” for a discussion on how these themes relate to the interpretive plan for the park.)

***Native American Contact With Euro-American Explorers and Settlers***

**Period:** 1769–early 1900s

**Theme:** Conflict, change and accommodation between opposing cultures

**Significance:** First contact with white culture; rapid deterioration of Native American settlements, lifestyles, cultures, and traditions due to Euro-American diseases, acculturation, and encroachment; adaptation of Native American populations to resist or accommodate Euro-American encroachments.

***Spanish Pioneers and Settlers***

**Period:** 1772–1821

**Theme:** Exploration and Settlement in the Spanish Borderlands

**Significance:** Pioneering attempts by Spanish colonials to explore overland routes through the region to facilitate settlement of and communication between New Spain and its isolated California outposts.

***Mexican Pioneers and Settlers***

**Period:** 1821–1848

**Theme:** Exploration and Settlement in Mexican California

**Significance:** Continuation of pioneering attempts to explore overland routes through the region to facilitate settlement of and communication between Mexico City and Republican Mexico’s Californian province.

***Anglo-American Pioneers and Settlers***

**Period:** 1827–1848

**Theme:** Exploration and Settlement in Mexican California

**Significance:** Pioneering attempts by Anglo-Americans to establish trade linkages between the United States and Mexican California.

***Early Anglo-American Military Engagements***

**Period:** 1847–1890

**Theme:** ABDSP as witness to Historic Military Activities

**Significance:** Movement across the desert of troops engaged in the Mexican War, Native American uprisings, the U.S. Civil War, and the Indian Wars.

***Development of Early Transportation Linkages***

**Period:** 1848–1940

**Theme:** Establishment of Pioneer Transportation and Communication Networks across the Desert

*Significance:* Improvement of overland mail, passenger stage, and automobile highway routes between California's southwest coastal region and the rest of the United States.

***Prospectors, Homesteaders, Ranchers, and Real Estate Developers***

*Period:* 1872–1970

*Theme:* Pioneer Settlement, Ranching, Mining, and Related Activities

*Significance:* Attempts by individuals or groups to exploit, settle, and otherwise reside in the desert environment.

***Creation and Early Administration of ABDSP***

*Period:* 1932–1942

*Theme:* Attempt by California State Parks and others to Develop and Administer ABDSP for Recreational Purposes

*Significance:* Efforts to create and administer the Park prior to World War II.

***Modern War, the Space Race, and Scientific Exploration***

*Period:* 1941–1973

*Theme:* The impact of World War II and the Cold War on the Desert Environment

*Significance:* U.S. military exploitation of the park for training purposes during war and peace, experimentation and advances in rocketry, and radio space exploration, paleontological and archaeological investigations.

***Postwar Era***

*Period:* 1946–1966

*Theme:* Conflict between Desert Conservation and Real Estate Development

*Significance:* Continuation of California State Parks' efforts to administer the Park during the postwar era, amid pressures of outside development upon the Park's resources.

**2.2.3.3 *Designated Historical Resources***

ABDSP has an impressive inventory of historic resources. Scattered throughout its rocky canyons and arroyos, down to its sandy washes and dry lake beds are historic sites that document the flow of history. The earliest of these are associated with Spain and later Republican Mexico's early attempts to exploit protohistoric Native American trails in order to establish lines of communication and settlement between Mexico and its northwestern coastal territory. Later, Mexican and Anglo-American settlers and soldiers developed these and other trails into roads, highways, and railroad right-of-ways. The Park also contains the abandoned remnants of those who chose to stay and eke out a living in the desert's harsh environment. These include fence lines, corrals, water tanks, and cabin foundations associated with a once active ranching/grazing industry, as well as those attempting to homestead.

Other sites contain the remnants of abandoned mines that tell the story of those who tried to extract the area's mineral wealth. There are also significant examples of the nascent State Park System's attempt to develop and improve visitor facilities. Among these are campground improvements and administrative buildings built in cooperation with the federally funded CCC program during the Great Depression. Other sites are associated with temporary military camps, auxiliary landing fields, gunnery training, and bombing ranges from World War II. The Park also contains historic resources associated with postwar activities. These range from the site of a radio observatory facility to movie locations. As more of these sites are recorded, the stories they can tell could be used to further interpret the park's history.

Although ABDSP contains numerous historic resources, only a few have been designated as historic sites. The Fages-De Anza Trail-Southern Emigrant Road is listed on the National Register of Historic Places, and includes portions of trails originally used by area Indians, later by wagons, and now in part by automobiles or footpaths.

The Juan Bautista de Anza National Historic and Millennium Trail was designated in 1990 by congress as the first of five National Historic Trails in the United States. Segments of the trail in the park are part of a larger 1,200-mile National Historic Trail from Tubac State Historic Park in Arizona, to the Presidio in San Francisco. In 1999 it was elevated in status to a National Millennium Trail, one of sixteen in the United States. Efforts are underway to designate it as an International Historic Heritage Trail by linking it with the historic route from Tubac to Horcasitas, Mexico.

There are also nine California Historic Landmarks within the Park:

- £ · Box Canyon
- £ · Butterfield Overland Mail Route
- £ · El Vado
- £ · Palm Spring
- £ · San Gregorio
- £ · Santa Catarina
- £ · San Felipe Valley and Stage Station
- £ · Pedro Fages Trail
- £ · The Vallecito Stage Depot (Station)



### 2.2.3 AESTHETIC RESOURCES

*“Certain desert areas have a distinctive and subtle charm, in part dependent on spaciousness, solitude and escape from the evidence of human control and manipulation of the earth, a charm of constantly growing value as the rest of the earth becomes more completely dominated by man’s activities. This quality is a very vulnerable one.”*

*Frederick Law Olmsted Jr.  
Report of State Park Survey of California  
December 29, 1929*

The aesthetic experience is complex, defying easy explanation. Springing from an inherent human longing for beauty and harmony, it is certainly connected to our senses and perceptions. The sensory experience, involving seeing, hearing, smelling, touching, and tasting, is influenced by socialization, education, and culture. A sense of aesthetics is unique to human beings. Above all, aesthetic appreciation is subjective. A stark desert landscape, which may evoke fear and repugnance in one person, could be a source of delight, awe, and inspiration to another.

Virtually every written description of ABDSP, whether written by naturalist, tour guide, novelist, politician, or poet, touches on this desert’s unique scenic beauty, wildness, and mystery. This appreciation can apply to subjects as widely divergent as a spectacular sunset or desert vista, the nightly serenade of a coyote, the spicy odor of rain-wet creosote, an enigmatic Native American pictograph, or dirt road winding into the distance. It can even apply to modern-era human contrivances, including the Park’s world-renowned Visitor Center, a man-made treasure hidden under a desert garden like the burrow of an animal.

Some of the desert’s enigmatic character comes from its unfathomable shifts in scale, allowing for an infinite range of possibilities, contrasts, and contradictions. The rugged, austere landscape is a tangible chronicle of 500 million years of geological diligence. But in the blink of an eye or turn of the road, the desert experience can become ephemeral and fragile, allowing brief glimpses of the fugitive beauty of dawn and dusk, a summer storm, a winter day, clouds, wildflowers, and the play of light on the face of a mountain.

Just as certain characteristics can summon positive emotions, other features can detract from the participant’s pleasure in the Park experience. These undesirable (to some) features include human-fashioned intrusions like power lines, road cuts, buildings, signs, and lights. They include human activities and the impacts of these activities, including noise, traffic, waste, litter, exotic plant species, damaged plants, smog, mining and off-road scars, and crowding. And they include assailants from the natural world like wind, dust, pollen, flash floods, insects, sharp spines,



poisonous animals, searing heat, and bitter cold. Yet, for every aspect of the Park experience that may have a negative implication for one person, there may be another person for whom those aspects hold a certain charm or attraction. Beauty is, indeed, in the eye of the beholder.

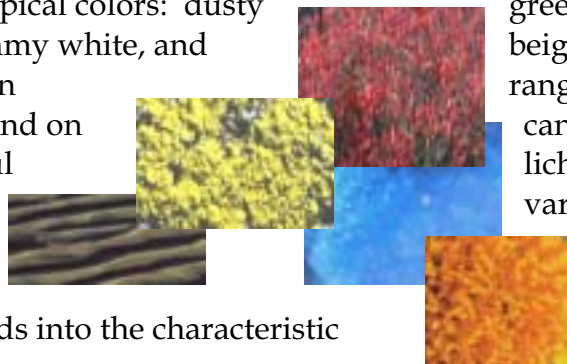
### 2.2.3.1 *Special Qualities*

#### Light

Light in the desert is played to extremes, from the blinding white light of noontime in summer, to the blackest night illuminated only by starlight. The quality of light is a visual experience. Those who photograph desert light can appreciate its multitude of qualities – faint winter washes, ethereal back-lighting, metallic glints, low-angled lighting of a hillside that selects out only certain of its features, atmospheric glows, mystical cathedral lighting, cascading sparks of fast running streams, or the sudden, holy illumination of things not seen before.

#### Color

Desert color is a phenomenon that attracts legions of sightseers, as well as landscape painters and photographers. While they attempt to capture an impossibly wide range of hue and tone on canvas or film, the coloration of landscape and sky changes with each passing hour, day, and season. Spring brings the startling brilliance of wildflowers, staining the desert floor with purple, magenta, yellow, and scarlet. In contrast, the subtle, sun-washed tones of the resident shrubs paint the desert in its more typical colors: dusty greens, chalky blue, bleached silver, creamy white, and beige. Mineral colors lie exposed in mountain ranges, rock outcroppings, and boulder fields and on canyon walls. They may be crusted with colorful lichens or darkened under a patina of desert varnish. Ultimately, when they are blended into granular desert pavement, this rich assortment of singular colors blends into the characteristic pale background of the desert floor.



#### Water

In its many permutations, water has played a role in the landscape and life of ABDSP for over half a billion years, and continues to be an important player today. From the creation of geological sediments laid down at the bottom of a primeval lake, to formations sculpted over the course of thousands of years, to the sudden geographic changes wrought by intense seasonal storms and flash floods, the Park is a monument to the tenaciousness and power of water. In this parched landscape, the refreshing, life-giving companionship of water and shade (like that found in a palm oasis) is a primal pleasure.

### Skies

ABDSP's renowned crystal blue skies are sometimes studded with clouds casting their own shadowy impressions upon the landscape. A cloak of clouds may hug mountain ridges like a fuzzy sweater for months at a time, giving way on summer afternoons to towering thunderheads. At night, the sky hosts exquisite astronomic shows of moonlight, starlight, comets, and fiery meteor showers.

### Seasons

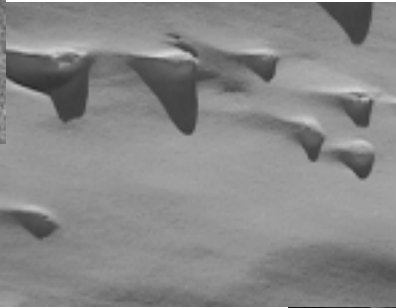
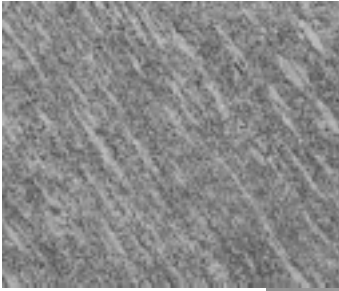
In the desert, the seasons are charted by subtle changes in mood, color, and light, as the angle of sunlight transforms the landscape. The summer landscape, a study in white and black, is succeeded by the cool blue shadows of autumn. The jewel tones of winter are succeeded by the brilliant kaleidoscope of spring flowers.

### Design and Pattern

From the geometric cracking in the surface of a dry lake, to the arrangement of overlapping scales on the belly of a snake, to the spiraling spines around the trunk of a Jumping Cholla, ABDSP is an infinite kaleidoscope of unique designs and repeating patterns. Fractals, the Golden Mean, and Fibonacci numbers all play a role in the natural mathematics that creates many of these designs and patterns. The Golden Mean is a mysterious natural number, like pi, that seems to arise out of the basic structure of our cosmos. It is a ratio that is present in the growth patterns of many things—the spiral formed by a shell or the curve of a fern, for example. The Golden Mean is intimately connected to the series of numbers called the Fibonacci Series, in which each number is the sum of the two previous numbers, beginning with  $1+1=2$ ,  $1+2=3$  and  $2+3=5$ . The ratio between these numbers is the same as the Golden Mean, 1:1.618. When naturally applied to a living thing, this ratio is not only responsible for arranging leaves around the stem of an ocotillo in such an order that each leaf receives the same amount of sunlight, it creates a balance that is also particularly pleasing to the human eye. The number of sides on the pentagonal fracture of mud in a dry lake is a Fibonacci number, just as is the number of spines in each swirl around a cactus stem.

### Texture

Texture is experienced both as tactile sensations – gritty, scratchy, prickly, sticky, sharp – and as visual images capable of evoking a tactile impression. Driving down a washboard road is a “felt” texture. Contrasts in visual texture – the play of soft, tufted grass against fine-leaved shrubs against rough granite boulders – help us to discern



one object from another. It also aids us in navigation and tells us something about an object’s nature.

### Form

Nature’s artistry is nowhere more visible than in

the desert, where all frills are stripped away to expose the primal beauty within.

It is easy to notice the characteristics of individual plants here, as they are

advantageously placed for survival at relatively wide distances from each other.

Other attention-getting qualities are spines, barbs, bristles, needles, and teeth. Some of the most memorable desert images are exquisite arrangements of shrubs and rocks. Traveling up Plum Canyon during an intense, late-spring wildflower bloom offers a marvelous unfolding of stunning beauty. Around each turn, one finds some new combination of succulents, flowering plants, grasses, boulders, and shrubs.



### Sounds and Silence

As the sounds of human civilization diminish in the wilds of the Park, natural sounds become more pronounced. From the delicate whirl of a hummingbird’s wings to the strident buzz of a cicada, from the gentle burble of a desert spring to the surging rumble of a flash flood, from the haunting woodwind notes of a breeze through the straggling arms of an ocotillo to the fierce storm-whipped thrashing of palm fronds, the variety of sounds can be astonishing.

It may be the relative absence of sound in some circumstances that many people find so appealing about the desert. Utter silence allows cleansing of the senses, introspection, reorientation to the ways of the natural world, and recreation in the most explicit sense of creating anew.

### Vastness

This vast landscape creates the perfect stage for the subtle, and not so subtle, movements of light, color, clouds, and seasons. It enhances the opportunity for solitude, and accompanying senses of peace, calm, and relaxation.

#### 2.2.4 INTERPRETIVE AND EDUCATIONAL RESOURCES

Spectacular resources await the public at Anza-Borrego Desert State Park®. Interpretation is often required to help visitors connect to these complex and far-reaching resources. ABDSP is proud of its long history of excellent interpretive programming and partnerships. Park volunteers and staff provide an array of well-attended programs throughout the Park. Non-personal interpretation is even more critical for this Park of over 600,000 acres, since many visitors may never come within even an hour's drive of the Park's visitor center.

Public demand has clearly exceeded capacity. School groups have been regularly turned away. There has been high demand for step-on bus tour guides that could be met through Park staffing or a high quality concessionaire. In addition, facilities are not large enough to accommodate the public, especially during the three months of wildflower season, resulting in long lines to view slide shows, use restrooms or talk to information volunteers.

##### 2.2.4.1 Facilities

A 7,000-square-foot Visitor Center provides interpretive exhibits, outstanding audio-visual programs, a self-guided nature trail, an interpretive garden, children's discovery lab, an outdoor amphitheater, and a Park-operated interpretive sales area. Additional interpretive facilities include outdoor campfire centers at Borrego Palm Canyon and Tamarisk Grove Campgrounds. These interpretive facilities are concentrated in the northern part of the Park.

##### 2.2.4.2 Personal Interpretive Programming

During the six-month peak season, visitors will find nature walks and hikes presented three to five times per week throughout the Park on over 20 different themes. Interpretive Naturalist's Talks are offered in the cool of the indoor Discovery Lab approximately seven times per week. Driving tours on designated roads for highway-legal vehicles are led on occasion. Topics presented include plants, animals, geology, paleontology, Native Americans, early settlers, desert safety, and solar cooking. In February, a special event weekend takes place with a theme such as Native American Days or Endangered Species.



The Parks's Junior Ranger program is offered on weekends and during school breaks. In addition, an after-school Junior Ranger Club for Borrego Elementary students is conducted. School Group programs aligned with the state educational content standards are offered at the Visitor Center. In

addition, each fourth grade student at Borrego Elementary participates in an all day ride-along with a ranger. Lastly, Park staff presents in-class programs to schools in Borrego Springs and Julian.

Evening campfire programs are presented on Saturday nights at Borrego Palm Canyon Campground and at Tamarisk Grove Campground. Star Parties to help visitors learn about the nighttime skies are held several times throughout the year at the Visitor Center.

Most of the Park's personal interpretive programming takes place from November through April. Rangers, the state Park interpreter, seasonal staff, and a large cadre of volunteers, conduct these programs.

ABDSP staff also presents Backcountry Seminars. These are in-depth programs that may last several hours. Some of the programs held at the Park have focused on flintknapping, preparing pottery in the Native American way, endangered desert bighorn, and bird watching.



Interpretive sales fulfill an important role in the overall interpretive program efforts. Books, guides, and educational souvenirs that promote the Park's mission and support its interpretive themes are available for purchase. National studies show that providing visitors with souvenirs fills a need to take home a tangible remembrance of the Park, while encouraging them to leave Park resources in place. Safety items such as compasses, water, and tweezers (for cactus removal) are also sold. Sales items are available at the Visitor Center, Tamarisk Grove Campground, and Borrego Palm Canyon Campground.

#### ***2.2.4.3 Non-Personal Interpretive Programming***

Because ABDSP is so large, non-personal programming plays an important role in the interpretive offerings. The Park's website ([www.anzaborrego.statepark.org](http://www.anzaborrego.statepark.org)) is the starting point for many visitors, offering directions to the Park, background information, interpretive program schedules, wildflower updates and school group information.

The Park publishes an annual Park newspaper. It is mailed out on request and given out free of charge at the Park. A free Park map is also included in the tabloid

Upon arrival at the Park, visitors may tune in to the Park AM radio presented through a partnership with the Anza-Borrego Foundation. Brief interpretive messages are rotated in and out of airplay, including safety messages. Non-English speaking visitors may pick up one of several foreign-language information packets at the Visitor Center.

Nine information kiosks are stationed at Park entrances. Over 40 wayside panels are provided throughout the Park. There are nine self-guided trails, including both walking and driving tours.

Because most visitors come to ABDSP to view the spring wildflowers, a phone “hotline” is dedicated to wildflower information and is updated weekly during flower season and monthly during the rest of the year. A weekly publication is produced during flower season to direct visitors to the best blooms and provide information about the flowers and pollinators. This update also appears on the website with up-to-date photos and is quite popular. In addition, several hundred visitors request postcard notification (provided by the Park) of the peak of the wildflower bloom.

Exhibits depicting the plants, animals, paleontological and geological history, and Native American and early European settlement are on display at the Visitor Center. A small exhibit about the Kumeyaay is on display at the Tamarisk Grove Campground office.

## **2.2.5 COLLECTIONS RESOURCES**

### **2.2.5.1 Introduction**

The character and scope of ABDSP collections is largely determined by heterogeneous and enduring natural and cultural events and settings. The biochronological sequence of vertebrate fossils from ABDSP is of international significance, and paleontological materials comprise the major portion of the collection, totaling about 13,000 specimens. The fossils range from over 12 million to less than 0.5 million years in age, and consist of paleobotanic, invertebrate, and vertebrate remains. Natural history collections are comprised primarily of herbarium specimens and zoological materials, including a large collection of bighorn sheep skulls. Archaeological and historical museum objects, dating back at least 4,500 years, include significant archaeological stone tool assemblages and a large and significant sample of late prehistoric ceramic vessels.

Most ABDSP collections are adequately housed in the Colorado Desert District (CDD) Stout Research Center (DSRC). This facility includes laboratory and conservation space, collections storage, a research library, and archives.



#### *2.2.5.2 Major Interpretive Themes, Topics, and/or Periods of the Collection*

“A primary interpretive theme is the evolution of the Anza-Borrego Desert landscape and biome” (Pozzi 1977). Subsequently planned themes focus on the role of water in landscape evolution, prehistoric conditions, and modern biotic and human adaptations (Enhancement Project 1994, 1995). Geological development of the landscape, late Cenozoic paleontological settings, biological adaptations and ecological patterns in arid and semi-arid environments, prehistoric human adaptations and settlement in the desert conditions, and historic and modern land use patterns are additional planned interpretive elements.

The primary geological periods represented by the paleontological collection are middle Miocene, 12–15 million years ago (MY), and late Miocene and Pliocene through middle late Pleistocene 6.5–0.5 MY. The earliest and latest stratigraphic records for a number of extinct vertebrate taxa are documented at ABDSP.

Archaeological lithic artifacts, primarily from the southern part of the Park, are classified by some investigators as belonging to the Malpais or San Dieguito traditions, and may be mid- to early Holocene. Mid-Holocene artifacts include Archaic, Elko period materials. Late prehistoric artifacts result from Cahuilla and/or Kumeyaay (Ipai, Tipai, and Kamia) occupation. Only a few historic artifacts date from early European occupation. Most historic materials are mid-20th century military items.

#### *2.2.5.3 Collection History*

Although marine invertebrate fossils were reported from the Colorado Desert region in the mid-19th century, paleontological investigations in what was to become ABDSP began in 1893 and continue today. Vertebrate fossils were first recognized and reported from the ABDSP area in 1901. During the mid-1930s, a team from the Frick Laboratory of the American Museum of Natural History actively collected in ABDSP. Curator T. Downs, J. White, and others associated with the Natural History Museum of Los Angeles County (LACM) conducted work from the mid-1950s through the 1980s. In the early 1970s, G. Miller, Curator of Paleontology at Imperial Valley College Museum (IVCM) in El Centro, began an active and productive collection and curation program of ABDSP vertebrate fossils that lasted through the end of the 1980s. The IVC collections were acquired by ABDSP in 1992 and the LACM vertebrate collections were transferred to the CDD in 1997. IVC and LACM materials now form the core of the DSRC vertebrate paleontological collection (Jefferson 1996, 1999).

In the later 1990s, the CDD and ABDSP established agreements for research and study and/or issued collecting permits (DPR 412-P) to a number of universities for graduate student and professional work on ABDSP geological and paleontological



resources. Also, ABDSP and CDD staff and volunteers have continued intensive survey, specimen recovery and conservation, and research and publication on ABDSP fossils. These activities have resulted in a steady growth of the paleontological collection.

M. Rogers of the San Diego Museum of Man performed the first systematic archaeological studies of the region during the early decades of this century through the 1940s (the collections are stored at the San Diego Museum of Man). During the late 1950s and early 1960s, archaeological materials were recovered during investigative surveys by C. Meighan of the University of California Los Angeles, and W. Wallace of the University of Southern California. The content of the archaeological collection has significantly increased over the past several decades as the result of surveys and research by R. Begole of ABDSP, site specific research studies (under DPR 412-A permits), resource and site assessments, and from mitigated development projects (Jefferson 1997). Archaeological investigations at prehistoric and historic sites continue to contribute specimens to the collection.

The natural history collections have grown substantially over the past 40 years. The herbarium collection was started in the 1960s, and has been actively growing since the late 1990s, in part a result of the General Plan inventory. Entomological specimens were also acquired as a result of the General Plan inventory in the early 1990s.

In the early 1960s, R. Banks and associates collected and prepared skulls and pelts of small mammals from ABDSP, mostly *Chiroptera* and *Rodentia*. In addition, ABDSP staff has acquired a small collection of varied mammalian osteological specimens. Many of these date from the 1950s and 1960s. *Ovis canadensis* skull samples were acquired primarily through field collection by ABDSP staff since the early 1960s. Recovery and curation of scientifically significant biological specimens by CDD staff and by graduate students and professionals under research collecting permits (DPR 65) is ongoing.

#### 2.2.5.4 Collection Content Summary

Paleontological materials primarily include fossil wood, coelenterate, arthropod, echinoid and mollusk shells, vertebrate skeletal and dental elements, and invertebrate and vertebrate ichnites. Over 500 taxa have been recorded. This wide variety of organisms represents a broad diversity of paleoenvironments and landscapes. Fossils have been recovered from the following geological settings: terrestrial vertebrates from mid-Miocene (10–12 MY) paralimnic deposits; pollen, marine invertebrates, and vertebrates from late Miocene (6.5–4.5 MY) marine deposits; terrestrial woods and aquatic and terrestrial vertebrates from late-Miocene (4.5–3 MY) deltaic deposits; pollen and lacustrine invertebrates from late Miocene,

Pliocene, and Pleistocene lacustrine deposits; and terrestrial and aquatic vertebrates from late Miocene, Pliocene, and Pleistocene (3–0.5 MY) terrestrial deposits.

Archaic through Late Prehistoric archaeological artifacts include a wide variety of flaked and ground stone tools, shell and wood items, ecofacts (plant materials, shells, and bone), and a large and significant collection of *ollas* (aboriginal ceramic vessels). A majority of the historic artifacts consist of hardware and/or munitions from World War II military exercises. Photographs, maps, and other documents are also part of the historic collection.

Although limited in scope and number, research-level synoptic natural history collections encompass botany, invertebrate, and vertebrate zoology, and geology. A modest botanical collection has been conserved. The small collection of invertebrates includes arachnoids, insects, mollusks, and other non-arthropods. Modern vertebrates are represented by a modest collection of prepared reptiles, primarily alcohol-preserved specimens, mammals, primarily skins, and skeletons, and a large collection of *Ovis canadensis cremnobates* skulls, mandibles and horn sheaths. Zoological specimens also include several sub-Recent specimens of *Antilocapra americana*, which is locally extinct.

Some paleontological, archaeological, historical, and biological museum objects are on exhibit at the ABDSP Visitor Center. All other paleontological and natural history specimens are housed at the DSRC. Cultural artifacts from ABDSP and the Ocotillo Wells SVRA are stored at the California State Parks Archaeology Laboratory in West Sacramento, the Borrego Archaeological Research Center at ABDSP, and the DSRC.

#### 2.2.5.6. *Uses of the Collection*

The collections support resource management, research, and interpretive activities of ABDSP and CDD staff, and research by the scientific community. The botanical, entomological, and zoological collections primarily serve as synoptic or reference specimens for identification purposes.

Some specimens or artifacts may be made available for ABDSP Visitor Center exhibits. However, hands-on use of core museum objects is highly discouraged and requires written permission (Morris 2001).

Because of the highly sensitive nature of associated records, locality, and/or site data, access to and use of this information must be restricted to qualified California State Parks, university, and museum staff. Presentation of specific locality data in a public format is prohibited.

#### *2.2.5.7 Relationship of Collection to Other State Parks and Non-State Park Institutions*

Marine invertebrate fossils recovered from the ABDSP region also are housed at the California Academy of Sciences, California State University San Diego, Natural History Museum of Los Angeles County (in part previously at the California Institute of Technology), San Diego Natural History Museum, Stanford University, University of California Berkeley, University of California Los Angeles, University of California Riverside, University of Chicago, and the USGS. Fossil vertebrates collected from the ABDSP region also are housed at the American Museum of Natural History and the San Diego Natural History Museum. No other state parks maintain comparable paleontological collections.

Large collections of similar, late prehistoric and historic archaeological materials from the ABDSP area are also conserved at the C. W. Bowers Memorial Museum, the Phoebe Hearst Museum, San Bernardino County Museum, University of California Berkeley, the San Diego Museum of Man, San Diego State University, Antelope Valley Indian Museum, and the University of California Los Angeles. The collections content of archaeological museum-materials, recovered from locations immediately south of ABDSP (i.e., Coyote Mountains and Yuha Desert of Imperial and southeastern San Diego Counties) is summarized by M. Weide (see Jefferson 1997).

San Diego Natural History Museum, Santa Ana Botanical Garden, and Natural History Museum of Los Angeles County maintain research-level botanical and/or zoological collections that include specimens representative of southeastern California and Colorado Desert habitats. The San Diego Natural History Museum houses a representative collection of ABDSP specimens in their herbarium.

## 2.2.6 RECREATIONAL RESOURCES

**recreation** (rek' re a' shen) n.

1. *refreshment in body or mind by means of some pastime or agreeable exercise.*
2. *a diversion or other resource affording relaxation and enjoyment.*
3. *restoration, recovery.*
4. *the act of creating anew.*

### 2.2.6.1 The Visitor Experience

ABDSP attracts a diversity of visitors who have separate specific interests, but may share many of the same concerns when it comes to the overall experience they are seeking. The Park attracts people who are interested in driving on paved and primitive roads, walking, hiking, horseback riding, mountain biking, hang gliding and flying airplanes. It attracts people who are interested in wildflowers, birds, bighorn sheep, reptiles and amphibians, geology, paleontology, astronomy, Native Americans, ethnography, history, and solitude. It attracts people who have never seen the desert before and are visiting for the first time, and it attracts people who appreciate this unique desert area and have visited hundreds of times. (See also Spirit of Place, page 1-4.)



### 2.2.7.2 Current Visitor Information

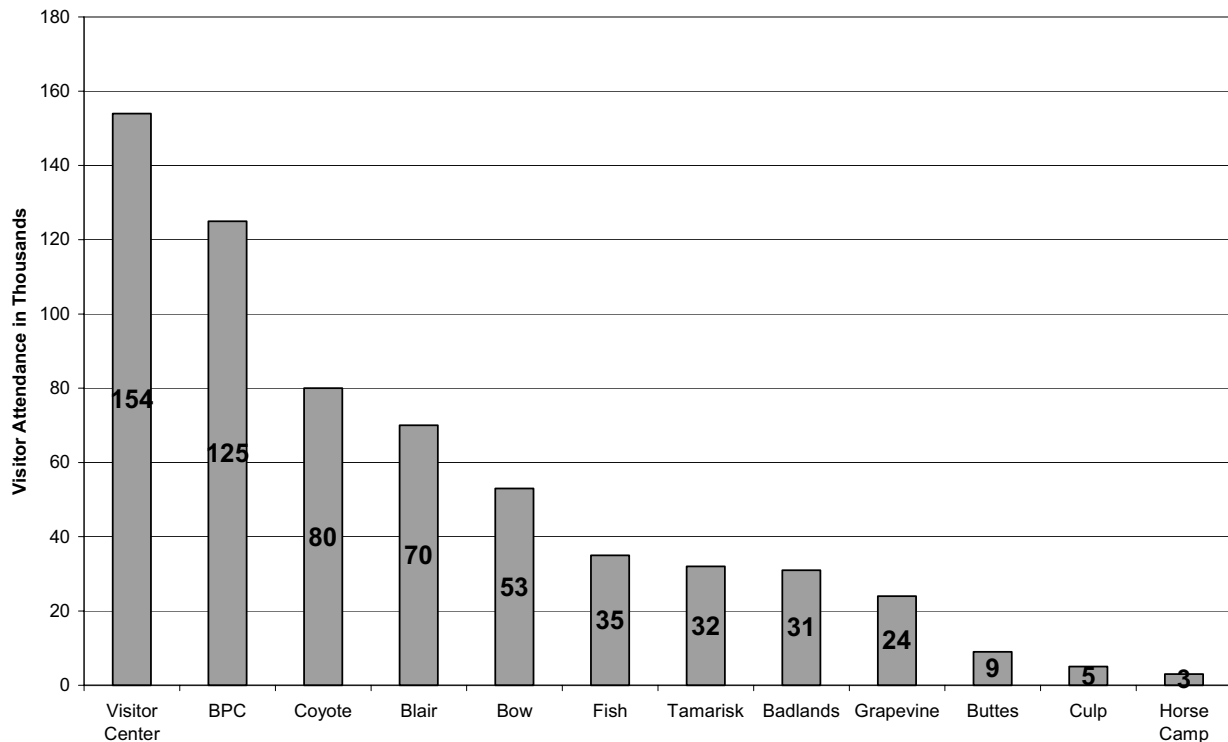
An average of 600,000 people visit ABDSP each year, with annual attendance during the last ten years ranging from 424,000 to almost 900,000. Attendance varies widely depending upon weather patterns and the success of the wildflower bloom. Eighty-five percent of the attendance occurs in the 6-month period between the months of November and April, with as much as thirty-five percent (over 300,000 in 1992) occurring in March alone during a good wildflower year.

Approximately three-quarters (76%) of Park visitation is day use. Approximately three-quarters of Park visitation, occurs in the north half of the Park (north of Highway 78), but only two-thirds of the camping occurs in the north. This translates to the following disparity in the ratio of day use to camping between the north and

south halves of the Park. In the north, the ratio of campers to day users is 1 to 3.5, while in the south; the ratio is 1 to 2.

As demonstrated in the following chart, almost half of the Park's total average visitation occurs at the Visitor Center and Borrego Palm Canyon (279,000). Park records show that the average visitor attendance in the outlying areas of the Park ranges from a high of 80,000 in Coyote Canyon to a low of 3,000 (less than 1% of the total) at the Horse Camp.

**Average Yearly Attendance by Area**



### **2.2.7.3 Recreational Infrastructure**

#### **Paved Roads**

Approximately 6 miles of paved roads are owned and maintained by the Park. In addition, over 100 miles of paved public roads pass through or are adjacent to Park lands, facilitating Park access. These paved, public roads, are managed by the State Department of Transportation (State Highways 78 and 79, and Interstate 8) and the County of San Diego (County Highways S1, S2, S22, and S3). Activities on or near paved roads include auto and bicycle touring, walking, jogging, camping, and wildflower viewing. Many of the most popular destinations are in proximity to paved roads and include facilities offering visitor services, campgrounds, the Visitor Center, and scenic attractions.

### Primitive Roads

There are approximately 410 miles of unpaved roads in the Park. These roads vary widely with respect to condition and ease of passage. Two-wheel drive highway-legal vehicles easily travel some routes, while others are suitable only for four-wheel drive highway-legal vehicles. For example, the Palm Spring/Vallecito Wash, and Fish Creek/Sandstone Canyon areas are primarily four-wheel drive routes. Typically, about 8% of the 410 miles of road are open to two-wheel drive highway-legal vehicles. Weather and flooding can quickly change roadway conditions, causing temporary closures and varying route difficulty from year to year.



The following list summarizes what type of public use is allowed on the roads of the park:

- £ Highway-legal Motor Vehicles – Allowed on all roads.
- £ Hikers – Allowed on all roads.
- £ Equestrians – Allowed on all roads.
- £ Mountain Bikes – Allowed on all roads.
- £ Green Sticker and Unregistered Motor Vehicles – Not allowed. In 1987, off-road recreational vehicles that were not highway legal were prohibited in the Park.

Highway-legal vehicles, Mountain Bikes, and Equestrians are not allowed to travel off of the roads in the Park.

### Trails



There are approximately 100 miles of trails in the Park. This includes 50 miles of the Pacific Crest Trail, and approximately 36 miles of the California Riding and Hiking Trail. These trails can be grouped into three broad categories classified by their primary purpose: nature trails—those encouraging investigation into the natural world; cultural



trails—those giving a glimpse into the ethnography or history of a particular area; and scenic trails—pertains to all trails, but particularly to those that offer scenic vistas. Park trails offer many levels of difficulty, ranging from paved all-access trails to trails for visitors seeking a physical, technical, mental, emotional, or spiritual challenge.

- £ Hikers allowed on all trails.
- £ Equestrians—Allowed on Pacific Crest Trail, the California Riding and Hiking Trail, and specifically allowed on approximately 10 additional miles of trail, including Lower Willows Bypass Trail. Riding is limited to designated trails only.
- £ Mountain Bikes—Allowed only on Lower Willows Bypass Trail. Riding is limited to designated trails only.

Hikers are not restricted to trails or roads. Except for areas specifically excluded by posted Superintendent Closure, they can travel anywhere in the park.



### **Historic Routes**

A number of prehistoric and historic routes traverse the Park, including routes of Native American trade and seasonal migration, the Spanish period (Fages-1772, Anza-1774), the Mexican era (the Sonoran Road-1826), and the American era (Mormon Battalion-1847, Southern Emigrant Trail-1849, and Butterfield Stage-1858). In most cases, only traces remain of the original pathways and roads, and the exact routes are unknown. In some cases, the Anza Trail, for example, no physical evidence of the trail may exist at all. The original routes are entirely unknown except for diary descriptions identifying geographical landmarks. Some present-day roads and trails follow the general path of these historic routes, or pass adjacent to preserved portions of the trails and roads, but there is no fully preserved historic trail within the boundaries of the Park, with the possible exception of some Native American footpaths.



### Camping

Approximately one-quarter (24%) of visitors camp overnight in the Park. Camping experiences span the entire scope from primitive to full-convenience, ranging from backpacking in the Wilderness to tent and car camping in the backcountry, and on to the relative comfort of staying in a motor home in a developed campground with electrical hookups, only five minutes from grocery stores, restaurants, and gas stations.

- £ 51% camp in semi-developed (Bow Willow), primitive (Culp Valley, Sheep Canyon, Arroyo Salado, Yaqui Pass, Yaqui Well, Fish Creek, Blair Valley, and Mountain Palm Springs), and undeveloped areas where open camping is allowed. Bow Willow Campground includes 16 designated campsites.
- £ 47% camp in developed campgrounds (Borrego Palm Canyon and Tamarisk Grove). These campgrounds include 52 hookup sites, 92 non-hookup sites, and 5 group campsites.
- £ 2% camp in equestrian camps (Vern Whitaker). This campground includes 10 campsites.

### Visitor Center

Twenty to Thirty-four percent of Park customers visit the Visitor Center each year. In the last 12 years, annual visitation has ranged from 105,000 to nearly 300,000 in a good wildflower year. Depending upon the success of the wildflower bloom, 20–40% of customers visit during the month of March. The Visitor Center is a significant regional tourism destination, and serves as the orientation center for most first-time visitors to the Park.



### Wilderness

There are approximately 404,000 acres of land currently classified as State Wilderness within the Park. This accounts for approximately two-thirds of the Park, and includes 12 separate Wilderness areas, ranging in size from the 106,000-acre Santa Rosa Mountains Wilderness to the 5,200-acre Desert Oasis Wilderness.

State Wilderness Areas are designated using the National Park Service wilderness model, where the handiwork of humans is virtually non-existent, and natural processes prevail. Wilderness units are usually over 5,000 acres in extent. Paved roads, motorized vehicles, power lines, pipelines, radio towers, and buildings are not to be found within such wild areas. One of the primary purposes of Wilderness is to provide visitors with a true “wild” experience; one in which nature and natural processes predominate without manmade intrusions distracting the visitor’s senses of sight, sound, smell, and touch.

Many miles of primitive roads traverse the Park at the junctures between different Wilderness Areas, although motorized vehicles or powered equipment of any type are not allowed within the Wilderness itself. The road “corridors” between Wilderness Areas are managed as if they were “backcountry,” with camping allowed adjacent to roads, and in locations where no damage will occur to native vegetation.

The first Wilderness unit within ABDSP was the Santa Rosa Mountains State Wilderness, proposed by Park staff, and designated by the California State Legislature in 1974. In 1982, the Santa Rosa Wilderness was expanded and eleven other roadless areas of ABDSP were presented to the State Parks and Recreation Commission for inclusion into the State Wilderness system. All proposed Wilderness sub-units were designated under the classification of Anza-Borrego Desert State Wilderness. Today, the newly designated Santa Rosa and San Jacinto Mountains National Monument, administered by the BLM, bounds the Santa Rosa Mountains State Wilderness on the north.

#### *Airborne Activities*

*Sky Trail* – Approximately 15 sky trail maps are purchased each year. In this low impact activity, pilots are guided on a 175-mile tour of the natural and historic features of the Park, some of which can only be seen from the air. The Sky Trail begins and ends at Borrego Valley Airport. Taking off or landing an airplane within the boundaries of the Park is not allowed.

*Hang Gliding* – Hang gliders are currently allowed to launch by permit from Kwaaymii Point. Park Management may only designate landing areas within areas identified in the General Plan as Backcountry Zones.

*Ballooning/Other Aerial Activities* – Based on the Public Resources Code (Div. 5, Ch. 1, Art. 1, sec. 5001.7) and Title 14 of the California Administrative Code (Ch. 1, sec. 4304), hot air balloons and all other aircraft not previously described are not allowed to take off or land within the boundaries of the Park.

## **2.3 PLANNING INFLUENCES**

The recommendations established in the *Plan Section* of this document are the result of many factors. These include the existing conditions of the Park; the natural, cultural, and aesthetic resources; and the use of the Park by the public. The Coyote Canyon Public Use Plan was prepared in 1995. This document (and the results of five years of monitoring) shaped the decisions of the Plan Section as it relates to this particular portion of the Park. In addition, the influences of system-wide planning, regional planning, and public concerns have helped to define this plan and are summarized in this section.

### **2.3.1 SYSTEM-WIDE PLANNING INFLUENCES**

Some regulations, policies, and plans address issues that cross Park and regional boundaries. These system-wide planning influences may affect planning decisions at ABDSP. In addition, numerous Department Resource Management Directives help guide planning processes. Any system-wide plans developed in the future that contain specific recommendations pertaining to the use, operation, or management of the Park may also affect future planning decisions for ABDSP. See Appendix 5.3 for a complete listing of system-wide planning influences and Department Resource Management Directives applicable to this planning effort.

### **2.3.2 RESOURCE MANAGEMENT DIRECTIVES FOR CALIFORNIA STATE PARKS**

These directives amplify the legal codes contained in the Public Resources Code, the California Code of Regulations, and the California State Park and Recreation Commission's Statement of Policy and Rules of Order. The directives pertinent to existing or potential issues at ABDSP are:

- #4 – State Park Acquisitions
- #5 – State Park Development
- #8 – Establishment of State Wildernesses
- #9 – Boundaries and Developments in Wildernesses and Natural Preserves
- #11 – Establishment of Cultural Preserves
- #27 – Establishment of Natural Preserves
- #28 – Resource Impacts from Visitor Use
- #33 – Exotic Plant Introduction
- #35 – Wildlife Habitat
- #36 – Regulation of Natural Faunal Balance
- #41 – Protection of Paleontological Resources
- #46 – Protection of Scenic and Aesthetic Quality

- #52— Native California Indian Participation in Management
- #58— Protection of Cultural Resources
- #70— Evaluation of Archaeological Values
- #74— Recreational Resources in State Parks

### **2.3.3 REGIONAL PLANNING INFLUENCES**

#### **2.3.3.1 Regional Plans**

- £ County of San Diego, Department of Planning and Land Use General Plan 2020
- £ San Diego Association of Governments (SANDAG) plans and programs
- £ Coachella Valley Association of Governments Multiple Species Habitat Conservation Plan
- £ Southern California Association of Governments (SCAG) Regional Comprehensive Plan And Guide
- £ Northern and Eastern Colorado Desert Coordinated Management Plan (BLM)
- £ Southern California Forest Plan (USFS)
- £ Santa Rosa and San Jacinto Mountains National Monument Management Plan (BLM and USFS)
- £ Missing Links: Restoring Connectivity to California Landscapes (California State Parks, U.S. Geological Survey, The Nature Conservancy, California Wilderness Coalition, Zoological Society of San Diego)
- £ Flat-tailed Horned Lizard recovery plan (see “Sensitive Biota”).

#### **2.3.3.2 U.S. Fish and Wildlife Service**

The U.S. Fish and Wildlife Service has designated critical habitat for the Peninsular Bighorn Sheep, Least Bell’s Vireo, and Quino Checkerspot Butterfly, including portions of ABDSP. Bighorn Sheep critical habitat encompasses roughly 435,000 acres distributed over the entire length of the Park. Least Bells’ Vireo critical habitat within the park is confined to a two-mile reach of Coyote Creek, though the species breeds in numerous riparian areas scattered throughout the park. Quino Checkerspot critical habitat encompasses roughly 450 acres in the extreme southern end of the Park.

#### *2.3.3.3 California Department of Fish and Game*

Fish and Game code 730(c)(1) – prohibits camping within 200 yards of water holes/wildlife watering place.

#### *2.3.3.4 California Department of Transportation*

Current roads and associated easements are known to fragment biological connectivity. This is documented for female Bighorn and developed roads.

#### *2.3.3.5 Landscape Linkages*

In California, urban sprawl, roads, and other anthropogenic forces are carving up habitat into ever-smaller fragments. Maintaining connectivity between the remaining natural areas and minimizing further fragmentation is crucial to the long-term viability of California's natural heritage. California State Parks is a partner in a statewide multi-entity effort to systematically identify, study, and protect vital habitat linkages and wildlife corridors. Through these efforts over 300 linkages have been identified and prioritized throughout the state; from large regional or landscape connections between habitat blocks or core areas, to narrow or tenuous corridors, to missing linkages that currently do not provide connectivity but for which restoration of a functional connection is deemed necessary. ABDSP represents a significant conserved core habitat area located in the southwest corner of the Mojave and Sonoran Desert Ecoregion. Four general linkages were identified between the park and other regional habitat areas. One landscape linkage, "Peninsular-Borrogo", connecting ABDSP and Cuyamaca Rancho State Park; one choke point linkage, "North Santa Rosa-San Jacinto", connecting the Santa Rosa Mountains in northern ABDSP to the San Jacinto Mountains; and two missing linkages, "Border I-8", which would connect the Park to Baja California, Mexico and "East West Imperial Coachella Valley", that would connect ABDSP to Joshua Tree National Monument and public lands east of the Salton Sea. While acquisitions are well under way for the Peninsular-Borrogo connection (Lucky 5 Ranch, Tulloch Ranch, Mason Valley, and others), preserving and/or creating the other three linkages will be a management challenge.

In addition, improved roads and highways located within the park, such as Interstate 8, State Highway 78, and County Highways S1, S2, S3, and S22, can act as barriers to the movement of animals within the park, resulting in fragmentation of the habitat. This effect has already been documented for Bighorn Sheep within the Park. Future re-establishment of rail activity within the Carrizo Gorge railroad corridor may contribute to further significant habitat fragmentation. Preserving habitat linkages will require working with transportation agencies to develop solutions for avoiding and ameliorating the fragmentation effects of improved roads on the Park's biota.

### 2.3.4 VISITATION

The following demographic information was compiled from a survey of Park visitors by California State Parks and researchers from the University of Montana. From November 2000 through March 2001, 2,400 surveys were administered (1,894 were returned) at six locations within the Park: the Visitor's Center, Borrego Palm Canyon, Coyote Canyon, Blair Valley, Fish Creek, and Mountain Palm Springs.

According to the survey results, visitors to ABDSP came from 39 states and 21 foreign countries. A total of 84% surveyed reported California as their home state. Over 56% of the California visitors were from San Diego County. About 5% of visitors reported their home country to be other than the United States. Large portions of these international visitors were from Canada and Western Europe. The gender distribution for Park visitors was 55% male to 45% female. Over half of the sampled visitors were between the ages 36 and 60 years. The visitors surveyed were generally highly educated. Visitors reported generally mid- to high-level household income.



More than 55% of the visitors surveyed came alone or with one other person. Eighty-seven percent of the visitors reported their group association was one of family or friends, or both. Stay lengths were generally short; day visits were the most-often reported stay length. Over 70% reported stays of two nights or less. Of those who reported staying at least one night, 54% stayed in primitive or developed campsites within the Park. An additional 20% reported staying in open camping areas within the Park during their visit. More than 47% of visitors reported having visited the Park at least once the previous year. About 26% of the visitors surveyed reported the current visit as their first.

The following visitor attendance figures were compiled by the California State Parks, Colorado Desert District and ABDSP. Between July 1989 and July 2002 visitor

attendance at ABDSP averaged 595,424 visitors per year. At 800,229 visitors, the highest attendance was recorded during the 1994/95 fiscal year. The lowest attendance occurred during the 1999/00 fiscal year with 424,236. The following table shows the seasonal attendance during the July 1989 – July 2002 period:

YEAR	MONTHLY AVERAGE	PERCENT OF TOTAL ATTENDANCE
July	6,574	1%
August	5,478	1%
September	8,945	2%
October	27,479	5%
November	61,084	10%
December	50,640	9%
January	59,209	10%
February	76,009	13%
March	148,826	25%
April	114,138	19%
May	35,706	6%
June	8,956	2%
YEAR TOTAL	595,424	

Between the fiscal years 1946/47 and 1999/00 total visitor attendance averaged 542,499. During this period, the high attendance was 1,570,399 visitors (1981/82) and the low attendance was 10,827 visitors (1946/47).

### **2.3.5 PUBLIC INVOLVEMENT**

Public input was solicited at several steps in the general plan process. More than 13 meetings were held during the preparation of this document. Large public workshops were held to capture a broad spectrum of public comment. Smaller focused group discussions involving off-highway vehicle, equestrian organizations, the local paraglider and hang glider association, and conservation groups were held to capture specific visitor-group issues and concerns. Input consisted of e-mails, letters, phone calls, as well as written and verbal comments captured at the public meetings.





The first set of public meetings, held in Borrego Springs, San Diego, and Manhattan Beach, provided an opportunity to describe the significant resources and unique features that make ABDSP a special place. These meetings were opened to public comments, and all comments were noted. In addition, a questionnaire was distributed to those attending, to gauge what issues and concerns were considered most important. In general, the majority of respondents thought that the Park should be left wild and undeveloped, with open camping maintained. Maintaining vehicular access within the Park was an important concern as well.

At the second round of public meetings, held in Borrego Springs, Riverside, and San Diego, participants noted specific concerns and commented on proposed management zone alternatives and general plan guidelines. After the meetings, the proposals were reevaluated and, where appropriate, rewritten to incorporate these comments and suggestions. The overriding concerns, both pro and con, were related to the potential development of areas designated as Focused-Use Zone 1, and maintaining or increasing vehicular access to some areas within the Park.

A final set of public meetings was held in Borrego Springs and San Diego to describe the preferred plan. The public was invited to ask questions and provide comments. These were again noted and reviewed after the meetings. Essentially, the same concerns were voiced as at the previous public meetings. There continued to be concerns voiced on both sides of the issue with regard to increasing vehicular access.



Throughout the course of public involvement in the general plan process it was clear that the common desire among all user groups was to maintain access within the Park, limit Park development, maintain open camping, and preserve the wildness and inherent peace and solitude. The majority of the written and verbal comments received during this process indicated a general desire for the Park to stay as it is, with no new facilities or operational changes of any kind. Some of the organized visitor-groups pressed for expansion of recreational facilities (including new trails, roads and glider landing areas) and recreational opportunities. There was little or no support among all groups for development of new campgrounds or other visitor services facilities, with the exception of minimally developed visitor



information kiosks at major entrances and intersections, for which there was some support. This input indicates that most participants highly valued the experiences they currently enjoy under the existing conditions.

The Preferred Plan emerged through incorporation of general public comments, resource data, and operational data obtained during the General Plan process as opposed to adopting any one of the alternative designs presented during the planning phase. Characteristics of each of the alternatives were used to formulate a plan that balanced protection of sensitive natural and cultural resources with providing opportunities for high quality outdoor recreation.

#### **2.3.5.1 Visitor Study**

One of the many influences that help shape a general plan is the visitor's impression of a park and their experience within it. To support the general plan, and to make informed management decisions, the planning team desired an understanding of their visiting clientele at the park. To this end, a visitor study was commissioned by California State Parks (University of Montana, ABDSP Visitor Study, July 2001, *see* Appendix 5.4). The study focused on five major features: first, characterizing park visitors and where they came from; second, to describe the nature of their visit; third, to determine visitor's motivations for coming to the Park; fourth, to discover the significance of the Park to visitors; and fifth, to ascertain visitors' perceptions of how the Park is being managed, or should be managed.

Researchers from the University of Montana were hired by California State Parks to develop and conduct a visitor survey for the park. Survey questions and categories were drawn from issues raised in general plan public meetings and identified by California State Parks staff.

The following objectives were developed for the study:

- £ Inform California State Parks staff about the nature of park visitors, their demographic characteristics, motivations, values, preferences, and evaluation of management.
- £ Identify salient visitor and management issues, both park wide and specific to individual areas of the park.
- £ Provide a sample of park visitors from a representative range of park settings. Six sites were identified: Coyote Canyon, Borrego Palm Canyon, Visitor's Center, Blair Valley, Fish Creek, and Mountain Palm Springs/Bow Willow.

Beginning November 2000 through March 2001, a survey of visitors to ABDSP was conducted. In all, 2,400 surveys were administered, with 1,894 surveys returned. The surveys were administered at the above six locations.

When asked about their reasons for visiting the Park, respondents consistently ranked a cluster of motivations: scenic beauty, unique characteristics, wildness, nature displays, and sanctuary for wildlife. Visitors' assessments of how the Park is managed were generally positive and supportive. As a group, visitors expressed an interest that the Park be managed as a refuge and as a showcase for displays of nature. Survey results indicate that actions related to the preservation of the Park's resources are viewed, by visitors, as more important than changes in facilities, or development targeting recreation use, visitor concerns, or local interests.

In all sites except the Visitors' Center, additional questions in the survey included presenting the visitors with a series of photos portraying a range of ecological or management conditions and asking them to rank each photo according to acceptability. In general, visitors preferred more natural, less impacted conditions, but were accepting of less-than-optimum conditions. In Coyote Canyon, the photos depicted a range of off-road impacts to vegetation, from pristine conditions to heavily scarred. A majority of visitors surveyed were accepting of a small amount of impact, the result of minor intrusions of highway-legal vehicle use, but at increasing levels, visitors judged conditions "unacceptable."

Surveys at Blair Valley and Fish Creek used the same approach to gauge acceptability, but the issue in these two locations was crowding. The photo series in this case portrayed a span of conditions ranging from solitude to extremely crowded conditions. In both sites, visitors displayed some tolerance for a certain amount of crowding but exhibited a threshold at which conditions became unacceptable. In general, the fewer the number of other groups in the photo, the higher the rating of acceptability.

The Borrego Palm Canyon and Mountain Palm Springs surveys included a photo series depicting a range of trail standards from primitive and unmarked to heavily signed and paved. The results from this set of questions were difficult to interpret. The vast majority of visitors indicated acceptance of all, but the most extreme conditions (such as signed and paved trails). The rating of acceptability increased with the conditions represented by photos depicting less primitive conditions. Rock trail-margins, wide paths, and some signs seemed to be preferred by a majority of visitors.

## **2.4 ISSUES**

These following are a summary of the major issues derived from the general plan process; however they are not intended to be a sum-total of the issues dealt with by Park staff. This plan attempts to resolve these issues with goals and guidelines, management zones and guidance for future planning efforts.

### **2.4.1 PHYSICAL RESOURCE ISSUES**

#### **Soils**

Soil is a key component of terrestrial ecosystems and provides a base for many of the processes that support life. Incorporating soil dynamics into management decisions is perhaps most important in the desert environment, where the extremes of climate have placed pressures on life unparalleled in many other terrestrial environments. Although researchers are addressing this aspect of the desert ecosystem, much remains to be learned. Open camping and off-trail hiking are popular activities that may have subtle yet significant negative effects on the desert ecosystem.

Sensitive desert soils and soil communities are thought to be one of the major limiting factors to natural resource restoration efforts in the desert. Also, the majority of the soils throughout ABDSP consist of various grain sized sand and sandy loam. These soils are highly erosive, especially when located within a major watercourse or subject to flash flooding.

#### **Geology**

The geological formations of the desert are major contributors to the grand and colorful desert landscapes of ABDSP. Vehicles and subsequent erosion can easily damage the varied geological formations and outcrops.

ABDSP lies in a very seismically active region. Earthquakes can trigger a variety of rock falls and landslides on the numerous steep slopes of desert canyons. Geological instability associated with the Arroyo Tapiado Mud Caves include very, internal collapse, and rock fall. In many instances, the cavities created by erosion have not been exposed or are thinly revealed.

#### **Hydrology**

Surface and groundwater quality, quantity, and natural hydrological patterns are essential elements for healthy biota in ABDSP. Much of the biota and many sensitive species throughout this region depend on isolated expressions of surface or subsurface waters. Throughout their length from headwaters to aquifer, the major watersheds that drain through ABDSP are owned by a variety of public land management agencies and private citizens. Lack of conservation ethics or breakdown of communication between these landowners may result in chronic

water quality and quantity issues and exotic species problems. Agriculture, golf courses, livestock grazing, tamarisk, and unsustainable urban development are of major concern for water resources in the Colorado Desert.

Currently there are several private water rights within the ABDSP which may threaten the integrity of the Park's natural resources.

Flash floods can be particularly dangerous in the park due to its vast size and the confined and incised nature of the canyons and washes. They are dangerous to park visitors and have the potential to destroy dwellings, structures, vehicles, and other features such as Park signs and the primitive road system.

#### **2.4.2 BIOTIC RESOURCE ISSUES**

##### **Paleontology**

Paleontological resources within ABDSP are of international significance. The geologically long and continuous fossiliferous stratigraphic sequence in ABDSP spans three geological Epochs (over 6 million years), the Ice Ages, and yields data relevant to determining the climatic origins of western North American deserts. The importance of these extraordinary qualities and the broad taxonomic diversity of the remains (over 500 species) have long been recognized by the scientific community. Protection and preservation in perpetuity of these unique resources is a direct responsibility of ABDSP.

Evaluation of paleontological significance and the recovery of fossil specimens are persistent management issues. Fossils may have interpretive, historical, and/or scientific significance. While the former are relatively easy to determine, scientific significance may not be readily evident. Most identifiable vertebrate fossils are significant and the deposits that yield such remains are ranked as highly sensitive. Invertebrate fossils are generally more abundant than vertebrate fossils, and the deposits that contain them are usually ranked as less significant. Exceptions are geological formations that yield dense accumulations of fossil woods and/or any taxa that are locally rare. For the purposes of intensive or cyclic paleontological surveys at ABDSP, all vertebrate fossils taxonomically identifiable to the generic and in some cases to the ordinal level or above are considered scientifically significant. Recovery of these specimens should allow researchers to address paleoecological issues at biological guild levels.

##### **Plants, Animals, and Habitats**

The biotic resources of ABDSP are highly significant; currently there are 26 wildlife habitats, 96 vegetation series, over 1,500 total taxa, and nearly 100 sensitive taxa documented within the boundaries. Some species such as the Sandstone Light Lizard and Cuyamaca Rock Cress are only known to exist within the Park. Habitats

such as vernal pools and desert riparian areas are among the most rare of all habitats in California.

Many of the sensitive species and a large portion of the region's biodiversity depend extensively on the Park's surface and subsurface waters and associated habitats. Although the localized and isolated nature of these environments may contribute to the development of biodiversity, these characteristics are also a major reason why these environments and the species that depend on them are so vulnerable to extirpation. Concentrated visitor uses, expanding impacts (such as open camping), adjacent land use effects on water quality and quantity, exotic species invasion, and random environmental changes may have dramatic and devastating consequences for these environments and especially the less mobile species. Once damaged, desert environments are very difficult to restore.

ABDSP is over 600,000 acres, of which the majority is roadless rugged backcountry and wilderness. There are more than 350 miles of border. The topography is dramatic and the climate often severe. Although the size and wildness of the Park are generally positive characteristics for preserving nature, they complicate the study and management of the biota and increase the potential for unchecked or unnoticed negative effects on the biological resources. Edge effects such as trespass, escaped livestock, water diversion, pollution, and exotic species introduction may have serious negative effects on the Park's biota and can creep in over a broad front.

Functional ecological systems are being manipulated or destroyed by rapid human development, leaving ABDSP among the remnant lands that will sustain wild plants and animals in their natural state. Ecological systems are dynamic and complex, requiring a major commitment of resources and intensive study to understand their intricate and essential details. In many cases, we are just beginning to understand these details. Much remains to be discovered about the biota and ecological systems of ABDSP and the effective methods for holistic management. Natural fire processes, soil dynamics, species interactions, the effects of recreational activities, exotic species control, and flood and drought events are among the forces that need further study and documentation, and incorporation into management practices.

### **2.4.3 CULTURAL RESOURCE ISSUES**

Within ABDSP, over 4,000 cultural resource sites are known to exist, with many more yet to be discovered. Cultural sites can tell us a great deal about the way others lived within this desert region and help us understand how each site fits into the larger picture or landscape. These treasured pieces of the past, are a valued part of learning about life beyond the present day.

Cultural resources include prehistoric sites (such as a pictograph) and historic sites (such as the Juan Bautista de Anza National Historic Trail). Over time, all of these sites can be threatened by forces of nature (wind, water, gravity) and by human activity (soil compaction, vandalism). Cultural resource sites are irreplaceable.

#### **2.4.4 AESTHETIC RESOURCE ISSUES**

To varying degrees, all aspects of the Park's beauty and grandeur are threatened by the activities of man:

- £ The blackness of the night sky is threatened by the spread of urban development and the ambient light that accompanies it.
- £ Indiscriminant footpaths and roads form artificial lines that slash across the textures and subtle lines of the desert.
- £ Early settlers introduced exotic plants that now choke out the native landscape and suck great amounts of water, drying out visually refreshing desert streams.
- £ Military aircraft flyovers and highway-legal vehicle traffic are noisy intrusions that overwhelm the overall sense of solitude and calm.
- £ Scenic viewsheds are not adequately identified and specifically managed for. Development outside of the Park but within its scenic viewsheds may spoil the visitor's sense of isolation and the Park's wilderness qualities.

The plan for the future of ABDSP seeks to ensure the protection of the aesthetic resources that delight today's visitors, guaranteeing that the Park's beauty and mystery will be here for many future generations to discover anew.

#### **2.4.5 INTERPRETIVE AND EDUCATIONAL RESOURCE ISSUES**

Many know ABDSP, to have "world-class" resources. Its diversity of desert qualities, significant features, and expansive scenery are renown. There exists a tremendous opportunity for both professionals and lay-people from near and far, to come to this Park for the unique opportunity to study, research, and celebrate these distinct resource qualities.

Although ABDSP has a very strong interpretive program, some visitors enter the Park without sufficient knowledge of the dangers existing in desert environments; and some visitors may leave without an appreciation of the desert's unique spirit of place. Park staff has found that many well-meaning visitors may not realize their actions can negatively affect Park resources, or just how sensitive these desert resources are.



#### **2.4.6 COLLECTIONS ISSUES**

Museum objects are unique and often non-renewable representatives of the geology, extinct landscapes, modern biotic environments, and cultural landscapes of the Park. They support the interpretive themes of the Park and are an essential element of research. As such, their conservation and care is important. ABDSP



collections span nearly half a billion years of history. They include a large and internationally significant assemblage of paleontological specimens, a growing collection of biological research materials, and a large collection of archaeological objects representing human activities and occupation in the region dating from the mid-Holocene. Due to the extreme climate in the Colorado Desert, the processing, storage, and display of the Park's collections require facilities that provide adequate protections from the elements. Currently, there are not enough facilities to adequately protect the Park's valuable collections.

#### **2.4.7 RECREATIONAL ISSUES**

The Park offers a variety of great experiences for visitors. However, many of the recreational values are often hard to define, and sometimes specific to each individual. Some active and passive uses of the Park may conflict with each other in areas of "shared use." Further, some activities may have potentially negative effects on sensitive desert resources (both natural and cultural) that define what this Park is about, and without which, most visitors would not come.

As populations and urban influences increase, so will the desire to "get-away-from-it-all." ABDSP certainly provides for visitors to escape their busy lives. Therefore, it is crucial for California State Parks to be proactive in planning for an increase in visitation, as well as the potential for new types of recreation. With an increase in visitation and recreational uses, visitor-use facilities and support facilities will need to be proportionally available.

Highway-legal vehicle use is the most common and effective means of gaining access to distant and remote places in the Park. Some people would never experience the desert if not for highway-legal vehicle access. However, this use sometimes conflicts with the experience of other users. In addition, improper use of highway-legal vehicles can lead to long-term damage to desert resources.

Equestrian use can be a great opportunity to enjoy the park in the same way as early pioneers. Horses provide greater access for people who otherwise would not want or be able to explore further reaches of the park. This use is limited to authorized roads and trails. As is the case with highway-legal vehicles, taking horses off designated roads and trails causes significant resource damage.

Open camping provides an opportunity for experiencing the solitude and wildness of the desert. This experience is virtually unparalleled throughout California and is a special attribute of ABDSP. Although open camping contributes immensely to California State Parks' Mission to provide high quality recreation, without subsequent planning and management actions, this activity may have negative effects on the Park's natural and cultural resources as well as some visitors' experience.

Other issues affecting the public's recreation within the Park include:

- £ Noise, light, and air quality are compromising the solitude, night sky, and clean air.
- £ Intensity of visitor use is not quantified. There is a perception that areas are taken away from public access without supportive data.
- £ Scenic viewsheds are not identified and managed for protection.
- £ In some locations, people feel crowded, which is precisely contrary to the reason they came to the desert.
- £ Selected areas suffer more impacts than others, leading to the question of whether visitor use should be concentrated or dispersed.
- £ Illegal activities such as drug trafficking, immigration, rave parties, vandalism, poaching, dogs off leash, ground fires, and littering, compromise the public's enjoyment of the park.
- £ Activities such as guided tours, commercial film production, and improper leaving of human waste also can compromise the public's enjoyment of the park.
- £ Relative to the size of the Park, there are very few designated hiking trails; some existing trails are poorly marked, and not easily accessible to a broad range of users including seniors, families, and disabled people. In addition, there are few connections to regional trail systems.
- £ During peak wildflower seasons the current facilities do not effectively accommodate the sudden surge in visitation.
- £ The road system is not planned to minimize resource impacts or maximize the visitor's experience or education. In addition,



parallel or duplicate routes of travel lessen the visitor's experience of solitude.

- £ There are limited recreational facilities to support visitor use (camping, day use), particularly in the southern half of the park.

#### **2.4.9 FACILITIES AND PARK OPERATION ISSUES**

Managing an area as large as ABDSP, staff is faced with unique operational challenges. In its remote location, communication systems, including cellular phones, are limited by range of use. With such vast expanses of land, dry conditions, and heat, there are many dangers associated with the desert environment. Consequently, there are also many opportunities for visitors to become caught off-guard by the temperature extremes and lack of water. Park staff often come to the rescue; however, these dangers as well as others, spell out a need for an expanding visitor safety program.



Further, staff is faced with long distances, wide-range patrol areas and the need to cover large areas single-handedly, with few bases of support and emergency facilities. In addition, due to the size of the Park and limited number of staff, there is little interaction between staff and visitors.

One of the major issues with the Park's facilities is tied to the seasonal component of visitation. Attendance varies widely depending upon weather patterns and the success of the wildflower bloom. 85% of the attendance occurs in the six-month period between the months of November and April, with as much as 35% (over 300,000 in 1992) occurring in March alone during a good wildflower year. During the summer months, many of the Park's visitor-use facilities are for the most part empty; however, during the spring months and especially with exceptional wildflower blooms, virtually all camping facilities are full and turning visitors away. This seasonal flux in visitation also creates staffing issues. The periods of high visitation demand a level of staffing and support personnel that exceed that of the remainder of the year.

As noted in other issues sections, the programs for Interpretation and Recreation will have future needs that may require the expansion of existing facilities and addition of new facilities.

#### **2.4.10 LAND ACQUISITION ISSUES**

Much of the private land bordering the Park holds valuable cultural and natural resources, not available to be enjoyed by the people of California. Further, these

valuable lands and resources are in danger of being exploited or destroyed. When land is acquired from the cooperative efforts of private organizations, individual donors, or purchased by California State Parks, it is only through willing sellers/donors.

Many times newly acquired land is sought for its landscape linkage value or potential habitat connectivity, its resource qualities, and in some cases for its previously disturbed site or established facilities. In the later cases these sites offer the opportunity for increased or improved Park facilities, without creating additional disruption or negative impacts to the Park's valued resource and experiential qualities.

Currently, there is no single plan for acquiring new lands.

### **2.5.11 ADJACENT LAND USE ISSUES**

Ecological systems throughout the region are being manipulated or destroyed by rapid human development, leaving ABDSP among the remnant lands that will sustain wild plants and animals in their native functional systems. Unfortunately, certain adjacent land actions affect the natural and cultural resources of the Park regardless of California State Parks' management practices.

Excessive water consumption is depleting the Colorado Desert water table and reducing surface waters. This alteration of the desert's ancient hydrological patterns is removing the key element in the desert ecosystem and placing all desert life in jeopardy.

Housing and industrial developments and transportation infrastructure are fragmenting biological landscapes that cross the Park boundary. These biological landscapes support species that must migrate for survival.

Urban expansion contributes to poor air quality, releasing pollutants and night-light, obscuring and diminishing viewsheds and night-skies. Urban areas also accelerate the number of trespass problems and threaten ground water and surface hydrology.

Future re-establishment of rail activity within the Carrizo Gorge railroad corridor may contribute to further significant habitat fragmentation and negative effects to natural and cultural resources.

The activities of the U.S. Border Patrol and illegal immigration have a negative effect on the Park's resources.